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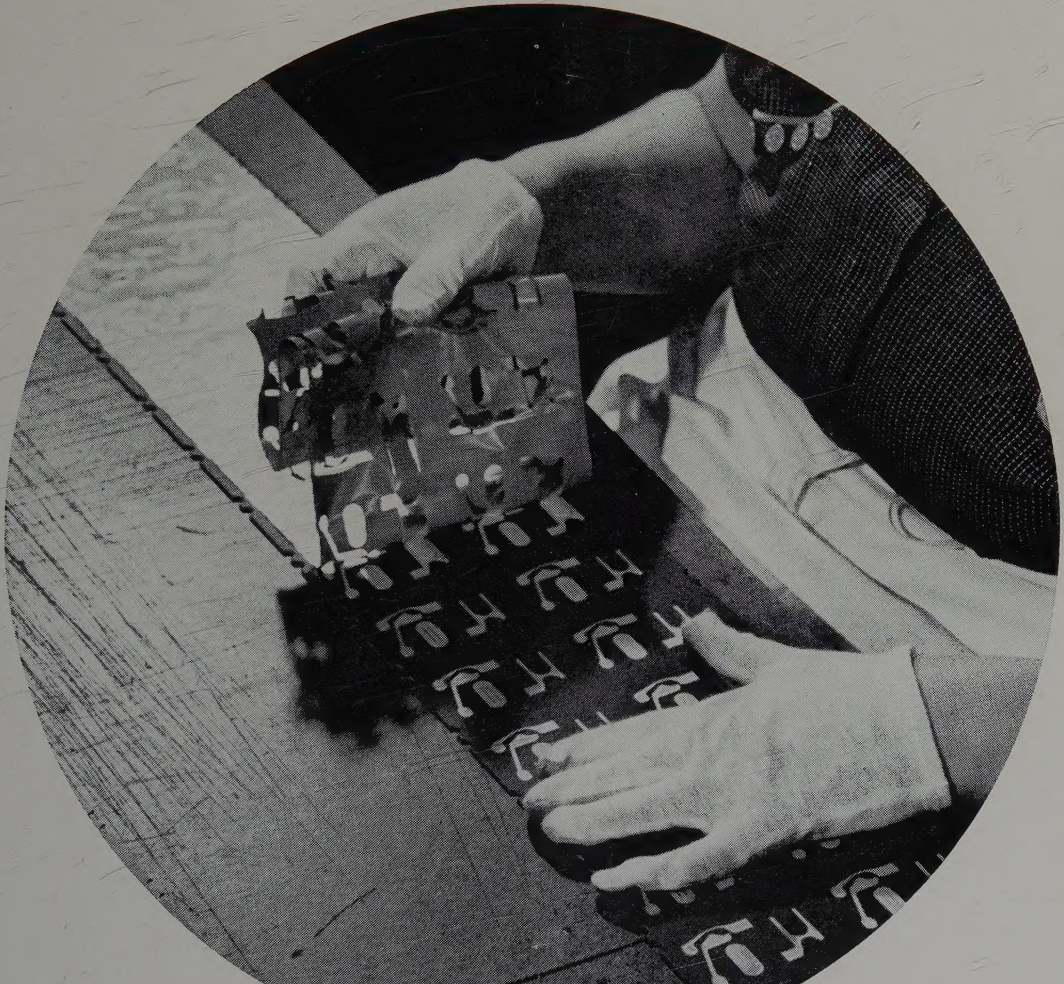
October 1961

Insulation



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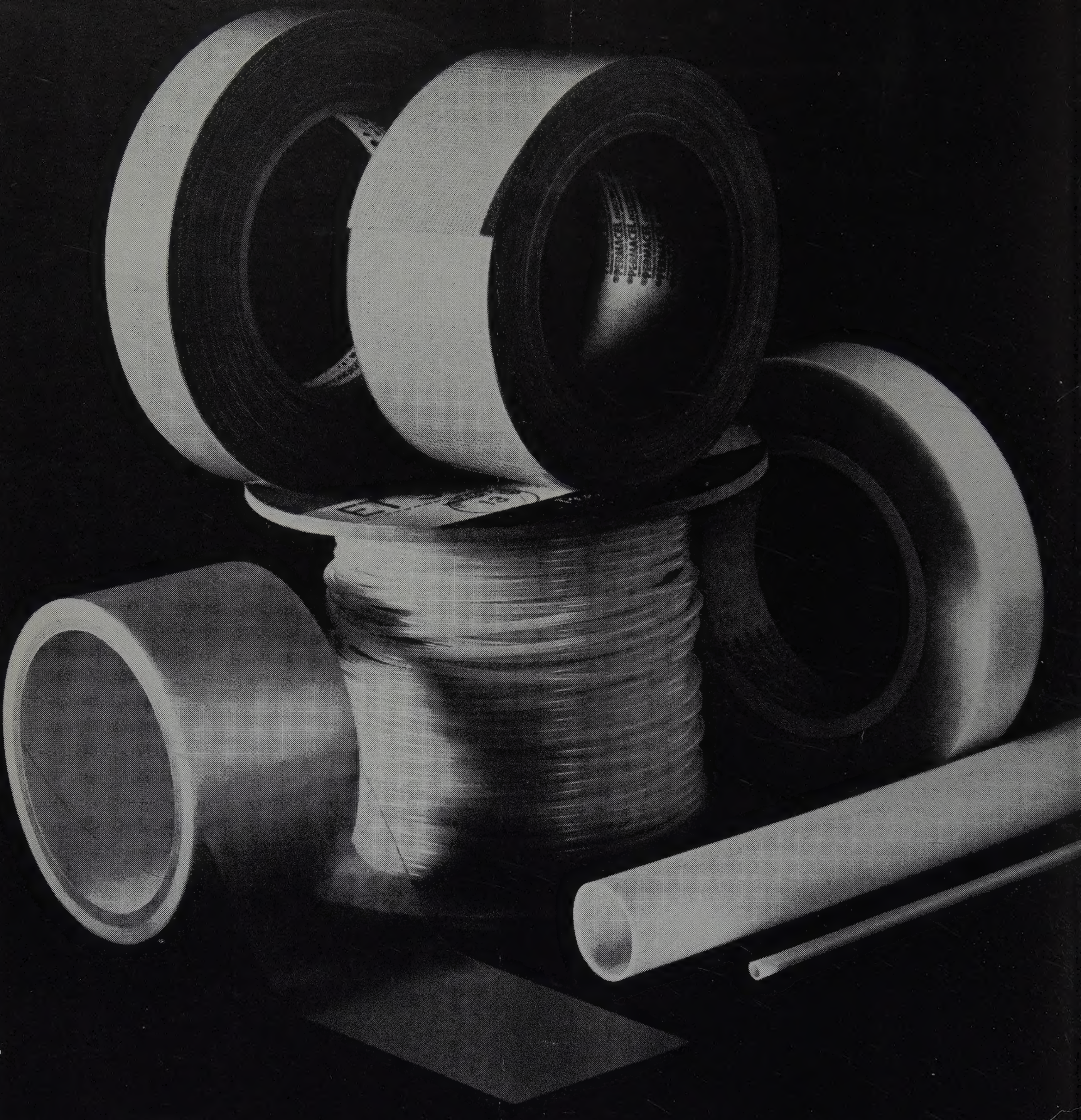

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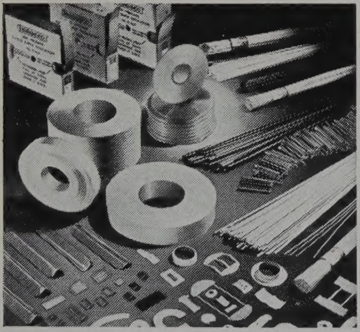
INMANCO DIVISION TO BECOME INMANCO INCORPORATED ON OCT. 1

OFFICIAL OF NEW FIRM IS ALSO A PROMINENT FIGURE IN INSULATION WORLD

A. Shirley Gray, administrative vice president and general manager of Inmanco Incorporated has been associated with the electrical insulation industry since 1919. Presently he is vice president and general manager of The Macallen Company, Inc., and Insulation Manufacturers Corporation as well as of the newly formed Inmanco Incorporated. He has been very active in the electrical/electronic industries as a member of AIEE, ASTM, and as one of the leaders in the first three Electrical Insulation Conferences. During World War II, he was consultant on built-up mica to the War Production Board in Washington. Among his outside interests, he is a member of the Board of Directors of the San Francisco Giants National League baseball club, and last year he accompanied the Giants on their six-week tour of Japan.

Company is Converter of Insulating Materials for The Electronic-Electrical Industry



Inmanco Incorporated, A Newly Formed Company Purchases the Manufacturing Division of IMC

CHICAGO—On October 1, 1961, the Inmanco *Division* of Insulation Manufacturers Corporation will pass out of existence. On that date, the recently organized firm of Inmanco Incorporated, will take over all equipment, tools, and inventories. The new Inmanco Incorporated will operate the facilities thus acquired as a separately owned and managed company. There will be no interruption in production.

The original IMC Manufacturing Division was formed in 1935, according to A. Shirley Gray, Administrative Vice President of the new firm, to provide electrical insulating material in the many special forms needed by IMC customers, products which supplemented those of IMC suppliers.

Since that time, the operation has grown rapidly to the place where it became desirable to round out the organization and increase facilities to provide expanded customer service, continued Mr. Gray.

The new firm of Inmanco Incorporated will engage only in the manufacturing and converting of nonmetallic materials for the electrical-electronic industry. Customers located throughout the United States and Canada, run the gamut from automobile parts manufacturers to makers of all types of electrical motor, generating, and distributing equipment, and producers of miniaturized equipment in the electronics field.

Inmanco Incorporated also offers a complete line of standard-packaged insulating products for the electric motor repair industry, including formed fibre wedges and cuffed paper coils. These are sold nationally through distributors.

Inmanco Incorporated will inherit all the skills and techniques gained through the pioneering and development of ways to fabricate many of the new insulating materials now on the market, continued Mr. Gray, and the company expects to accelerate this type of research.

The new company will work with electrical insulating materials of a wide variety of different types and grades of papers, plastic films, coated fabrics, mica, fibres, woods, and laminated plastics. High-speed equipment designed to shear, saw, slit, die-cut, crease, mill, form, and cuff are able to produce almost any type of precision insulating part. One of Inmanco's specialties is commercial, precision slitting of narrow and wide coils to extra close tolerances.

MANAGEMENT TALLIES 269 YEARS SERVICE IN INSULATION FIELD

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President

A. SHIRLEY GRAY
Administrative Vice President and General Manager

J. HAROLD MARTIN
Executive Vice President

JOHN E. JOHNSTON
Treasurer

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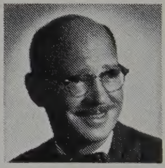
Manufacturing Vice President



W. BRADFORD WICKLAND
Manufacturing Coordinator and Purchasing Agent

STEPHEN L. KUBALA
Assistant Treasurer and Controller

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Insulation

For the Electrical and Electronic Industries

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From the Editor

Opinions and Rambling Thoughts

Statesmanship and Business

A continuous flow of reports from business concerns indicate that business as a whole is well out of the recent slump and that the economy is moving upward. Although there are some exceptions, most companies are citing increased sales. However, there are a number of firms which show increased sales but decreased profits. The primary reason for lower profits is lower prices.

Where low cost imports are not a factor, the basic cause of lower prices is domestic competition—one company figures it can get more business with a lower profit margin and soon the whole industry cuts prices so that the advantage to the original price-cutter is strictly temporary. Eventually, less money is being made on the same amount of business.

This situation is not just a concern of management—it also should be worrisome to engineering, production, and purchasing men. To meet lower prices management is frequently forced to cut more than just fat. Often, the future of the company is endangered because vital research and service activities are curtailed.

Business statesmanship on the part of individual companies is needed to overcome this problem. Acting individually, companies must decide to establish their prices at reasonable profit-making levels. If enough individual firms will do this within specific industry segments, there will be a snowballing effect which will return prices to their proper place. Those companies which do not follow the lead of the business statesmen might soon find themselves burdened with an unwanted price-cutter reputation. And once again the business statesmen will be able to sell quality, research facilities, and service.

We are just as rigidly opposed to excessive profits as we are to unreasonably low profits. The price situation in which we find ourselves today can only lead to trouble for many industries because sooner or later low prices will result in shoddy practices and shoddy products in attempts to recover lost profits.

Successor to Underwater Ball Point Pen

We note with interest that Du Pont's "Freon" Products Division displayed at the recent Western Electronic Show and Convention a tape recorder that plays back perfectly while its hi-fi amplifier is immersed in a tank of liquid solvent. Purpose of the demonstration was to show the dielectric and selective cleaning properties of Freon TF fluorocarbon solvent. However, because we have a close knowledge of a variety of rather odd-ball set-ups possessed by some hi-fi addicts, we suggest that Du Pont should try to broaden the audience for this demonstration—it could lead to a new fad for every home which owns a hi-fi set—a hi-fi set sitting in the middle of a tank of Freon TF fluorocarbon solvent in the living room.

Insulation Leakage Leads to Super Sensitive Sniffer

We don't know whether this really belongs on the editorial page but we can justify it on the basis that there might be some readers who think this column smells. It seems that our sense of smell is sensitive enough to detect certain odors in concentrations as little as one part in a million parts of air . . . but not content with such sensitivity, scientists at the Westinghouse research laboratories have developed an electronic sniffer that not only detects, but also exactly measures, concentrations of gases as low as one part in 10-million parts of air.

Called an electronegative gas detector (EGAD), the new instrument was developed primarily to detect and measure the concentration of sulfur hexafluoride (SF_6) gas which is used for insulating purposes in high voltage transformers, coaxial cables, wave guides, X-ray tubes, and circuit breakers. One use of the sniffer is to locate minute leaks through which the SF_6 gas might escape. The instrument reportedly can detect a leak so small that the escaping gas, in an entire year, would fill only the space inside a pack of cigarettes.

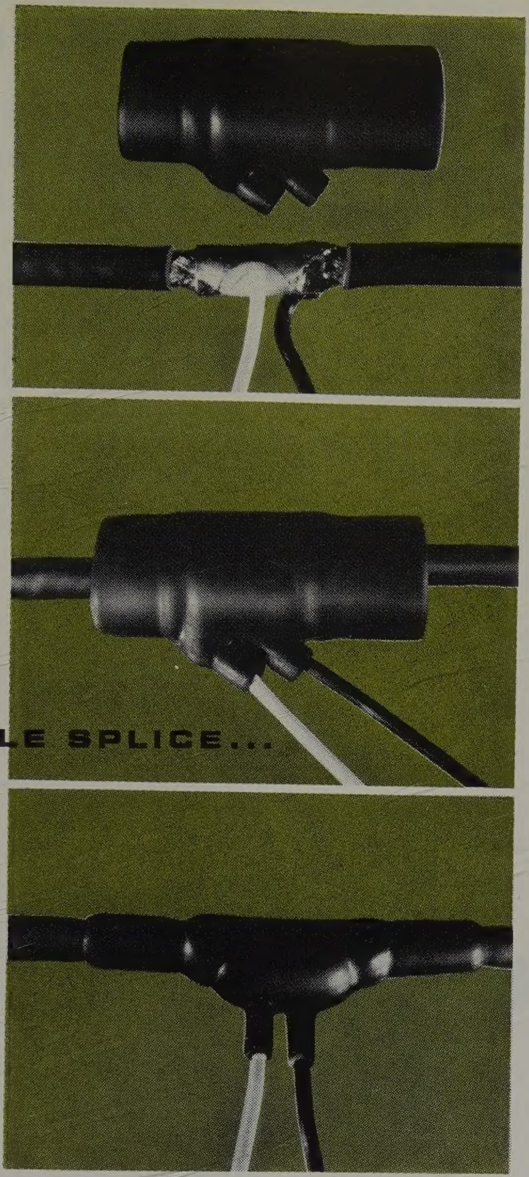
Essentially, the instrument takes in air suspected of containing SF_6, bombards it with electrons, and sorts out the SF_6 by its extra tendency to attract the electrons. The electron-hungry SF_6 molecules form ions that are less mobile than others that may be present. Therefore, they lag behind when the ions are electrically attracted to a positive terminal or anode. This time (phase) delay is read at the anode by a meter calibrated directly in parts per million of SF_6.

Undoubtedly, those cries of anguish you hear nowadays when passing through Pittsburgh are the wails of the members of the SF_6 Gas Smellers Union who now are being replaced by EGAD (we suspect the initial name of the instrument was somewhat forced).

In case you are wondering, the Westinghouse scientists did not explain what would happen if EGAD came down with a cold (perhaps they'd sell it to G-E).

Tell Mr. Hoffa

Another interesting but non-essential, non-insulation tidbit comes from Arthur D. Little Inc.—U.S. railroads actually started the piggyback service back in 1884 when the Long Island railroad started hauling farmers' wagons to market (without horses) on flatcars. We think the railroads should cite this precedent the next time Mr. Hoffa demands payment to the teamsters for every piggyback truckload.



COAXIAL CABLE SPLICE...

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This premolded encapsulating coaxial cable splice shrinks in seconds on exposure to 275°F. quickly and inexpensively accomplishing a moisture-tight seal. It is one example of a wide variety of standard molded Thermofit configurations available from stock in four different rubber and plastic materials. Any moldable configuration is available with short lead time. Parts will shrink to as little as 20% of the original diameter.

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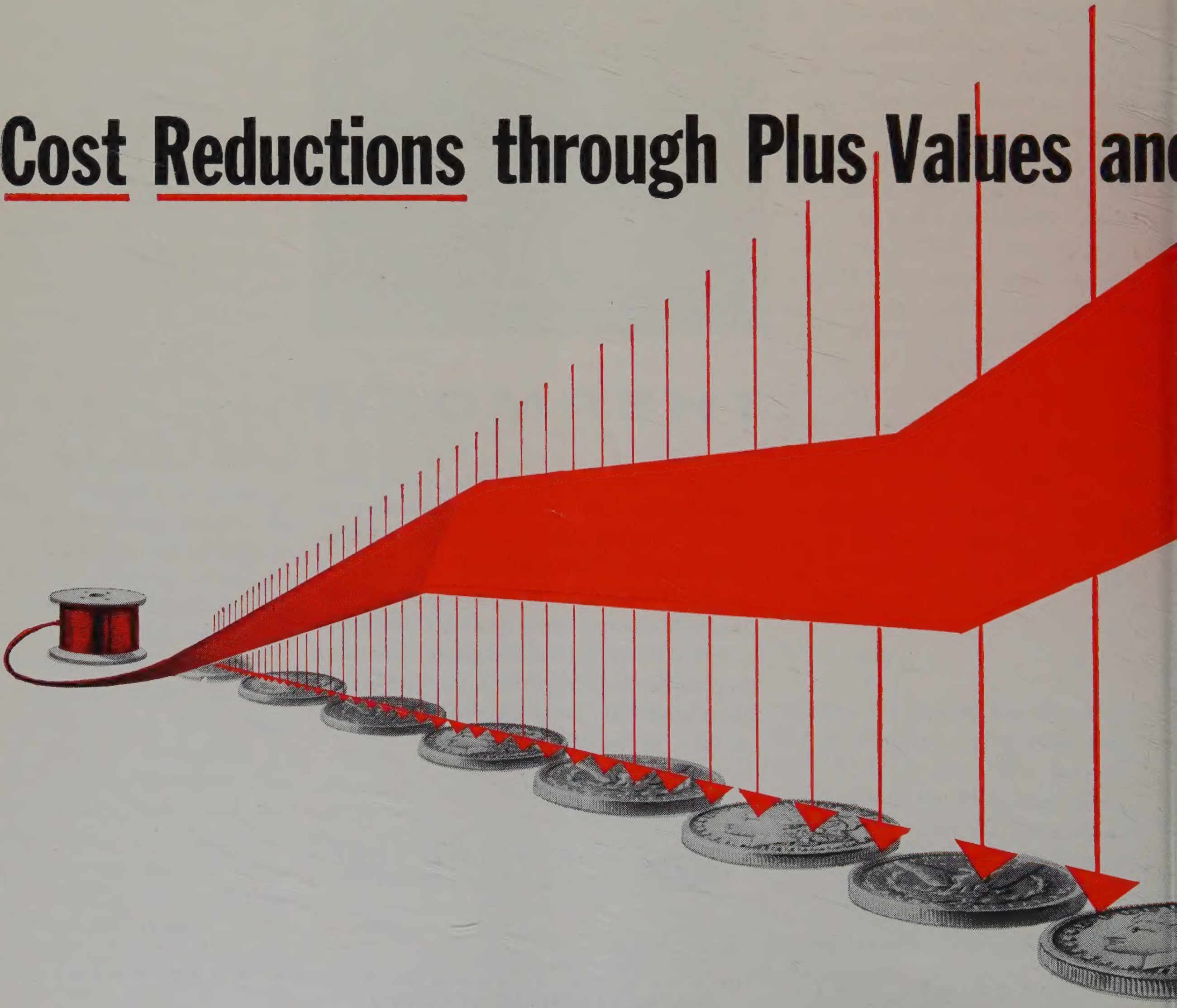

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News and Views

Many Exhibit Spaces Sold For February Insulation Conference

Within just a matter of weeks after the announcement mailing, commitments for nearly 100 exhibit spaces have been made according to William J. Dwyer, national exhibit chairman for the fourth Electrical Insulation Conference, to be held the week of February 18, 1962 at the Shoreham Hotel, Washington, D. C. With this enthusiastic support it is expected that all 133 exhibit spaces available will be sold well before the conference—more information on commercial exhibits may be obtained from Dwyer at Suflex Corp., 33-40 57th St., Woodside 77, N.Y.

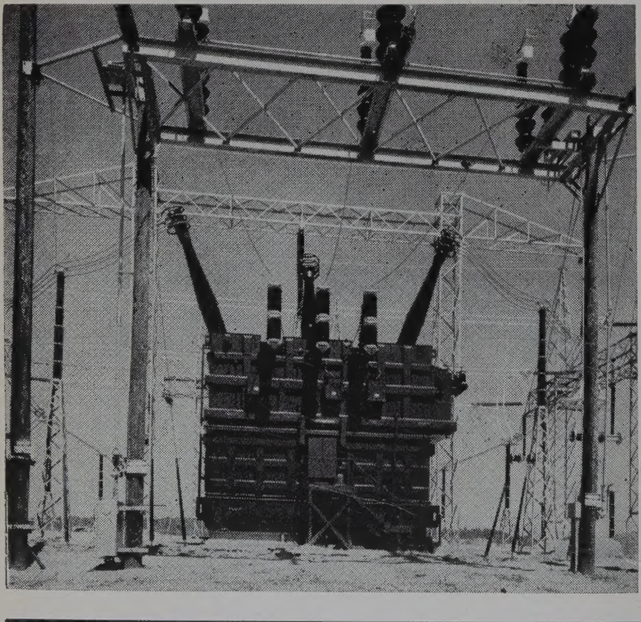
Reports received by conference general chairman Roger White, The Glastic Corp., indicate that plans for other conference activities are nearly complete—these include the technical program, conference banquet, promotion, tours, marketers meeting, publications, technical exhibits, awards, education, and AIEE and NEMA luncheons.

Continental Can Sells Conolite Operation

A new company, Conolite, Inc., Wilmington, Del., has acquired all Conolite plastic laminate operations from Continental Can Co. Inc. The new firm is headed and primarily owned by the same personnel who have conducted the Conolite operations in the past. R. J. McLaughlin is president. Expansion plans reportedly are under way.

GE and Westinghouse Energize EHV Test Lines at 770 and 775 KV

Both General Electric and Westinghouse have recently energized extra-high-voltage test transmission lines at voltages above 750 kv. The goal is to eventually make possible the transmission of large blocks of power at extra-high voltages over long distances with resultant less over-all investment and reduced per unit transmission costs. G-E operated the full, 4½-mile length of its prototype system at 770,000 volts to briefly test the insulators, conductors, and 18 different transmission towers. Continuous operation is now under way at 500 kv which reportedly is the next voltage level for utilities planning EHV systems. After about a year at 500 kv, the voltage will be raised to 750 kv.



Westinghouse tested its line at 775,000 volts and plans a five-year research and test program designed to gather information on operation at voltages up to 750 kv. Prime objective is to obtain data on corona loss and radio influence performance of conductors at a nominal voltage of 750 kv. Photo shows 138/750 kv transformer.

3M Resells Insulation and Wires Inc. To Essex Wire in FTC Consent Decree

As a result of a consent decree settlement between Minnesota Mining & Manufacturing Co. and the Federal Trade Commission, 3M has resold Insulation and Wires Inc. to Essex Wire Corp., Fort Wayne, Ind. Essex sold IWI, an insulation material distributing organization, to 3M in 1956. In the same year, 3M acquired Prehler Electrical Insulation Co., Chicago, another insulation distributor.

In 1960 the FTC filed a complaint alleging that both acquisitions violated the anti-merger act and asked that 3M be ordered to divest itself of both companies. In the consent decree settlement, the FTC has agreed to dismiss its charges in regard to the Prehler acquisition which means that Prehler will continue operations with its status as a 3M subsidiary unchanged. The settlement prevents 3M from acquiring an interest in any electrical insulation distributor for the next decade and stipulates that Prehler must purchase at least 22% of its products from outside suppliers. The agreement is for settlement purposes only and does not constitute an admission by 3M that the acquisitions violated the anti-merger act.

In 1956, IWI reportedly was the third largest electrical insulation distributor in the country with sales of some $6-million. No recent figures are available but Herbert P. Buetow, president of 3M, has declared that IWI accounted for only a fractional percent of the company's world-wide sales. All present employees of IWI will remain with the company.

Phenol Price Down

An across-the-board price reduction of ¾ cents per pound in the price of phenol has been announced by Dow Chemical Co., Midland, Mich. The new tank car price is 16¼ cents a pound freight allowed. Excess capacity throughout the industry and market conditions were given as the reasons for the decrease, the second this year.

Cam Action in Terminal Block Connector Molded Of Polycarbonate Resin

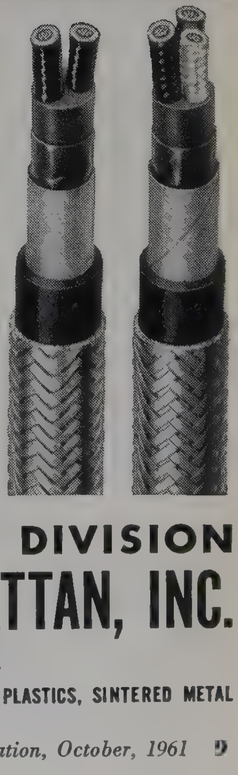
Polycarbonate resin was chosen for a terminal block connector which offers a new cam principle for simplified wire attachment. Self-extinguishing "Lexan" resin reportedly was chosen because of high dielectric strength (up to 4000 volts between terminals and 5000 volts between terminals and base) and dimensional stability. Other important properties of this resin are moldability, resistance to temperatures up to 270°F, and extremely high impact strength, which is said to make the connectors virtually crackproof.

Available in 15, 20, and 30 ampere sizes with from 2 to 20 stations, connectors are sold by Camblock Corp., Natick, Mass. Because of the cam action and the ability of one size connector to take from #10 to #30 gauge wires, they are reported to reduce wiring time by up to 75%. Typical areas of application include electrical and electronic equipment for aircraft, automotive, marine products, appliances, and lighting equipment.

Water with Ultra Low Conductivity

Using an electrophoretic ion-exclusion technique, the National Bureau of Standards has prepared ultralow conductivity water with a residual ionic impurity content only one third of the minimum previously reported. The water has an electrical conductivity indicating an ionic impurity content of only one part per billion.

R/M NOVABESTOS® TAPE
protects cables
in atomic subs



Only top-quality materials make the grade with suppliers of components for new atomic submarines. Novabestos high-temperature tape plays an important role in protecting cables installed in these advanced underwater craft.

The cables shown are produced in accordance with specifications MIL-C-2194 D and MIL-C-915-A. They utilize Novabestos tape as a binder and firewall.

Resistance to heat, water and corrosion, as well as good handling strength, make Novabestos tape a favorite with cable manufacturers. The cost per unit area is low.

Novabestos tape comes in a variety of asbestos and glass combinations and in many thicknesses, widths and core diameters. Have an R/M insulating specialist tell you more about the advantages Novabestos tape offers.

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SPECIALISTS IN ASBESTOS, RUBBER, ENGINEERED PLASTICS, SINTERED METAL
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European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Ill.

Continuous Testing of the Ionization in Medium Voltage Electric Cables

By J. P. Sabot in Revue Générale de l'electricité Vol. 70, No. 2, February 1961, pp. 83-88. Original title: Contrôle d'ionisation des câbles électrique secs à moyenne tension, par défilement continu. P. Sabot is with Tréfileries et Laminoirs des Havre (France).

With regard to plastic insulated cables, the tan δ measurement is of more importance than the voltage test in contrast to oil-insulated cables. Air bubbles can easily arise in the extruding process during the manufacture of these cables and if discharges appear at a voltage lower than the service voltage, the cable can be destroyed by the resulting corona. A voltage test usually gives no indication of the existence of such defective areas.

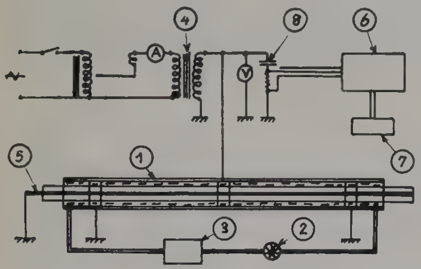


Figure 1, measuring installation for continuous control of the ionization in cables. 1. A cylinder, length 6 meters, constructed from insulating material with a measuring electrode in the center and an electrode at each end (screen). The cylinder is filled with demineralized water. 2. Water pump. 3. Water filter. 4. 50 c/s transformer. 5. Cable (conductor earthed) surface connected with the electrodes through the water in the cylinder. 6 & 7. Measuring and recording instruments for the oscillations coming from corona in the cable. 8. Coupling condenser.

The major problem is that the sensitivity of the recording instrument for the corona measurement (Schering bridge or corona detector) depends on the measured capacity, i.e. the total length of the cable. This necessary sensitivity can only be attained using short screened electrodes and even so the possibility of finding the exact position on the electrode length of the fault is limited.

In the article, a method of production control is described which allows short sections of the cable to be tested continuously. Using this method it is possible to discover any cavities without the use of special measuring electrodes. The arrangement is shown in figure 1.

It is difficult to decide which cavities are harmful and which are not. The connection between ionization starting voltage, the gradient of the breakdown voltage, and the results of aging is still unknown. Tests on this subject are difficult because ionization is not the only cause of breakdown. Ionization can appear only periodically or it can disappear after a time due to a self-healing effect.

At present, the author is carrying out aging tests. It takes a long time to obtain conclusive results because the aging voltage should not be too high. However, it can be expected that the results will show that voids must be prevented in a new cable.

The Charging Capacity and the Dielectric Absorption of a Condenser

By P. Boyer in Bulletin des Schweizerischen Elektrotechnischen Vereins Vol. 52, No. 15, July 1961, pp. 561-563. Original title: Das Ladungsvermögen und die dielektrische Absorption eines Kondensators. P. Boyer is with Condensateur Fribourg S.A., Fribourg, Switzerland.

The article is concerned with charging and discharging current measurements as a means of judging the quality of insulation in condensers. The author regards these measurements as an interesting supplement to the usual present day tan δ measurements. Whereas the tan δ results give special information concerning ionization, the dielectric absorption depends on the microscopic structure, and the charging capacity on the insulation resistance. For a control of aging, the results of the absorption and tan δ measurements correspond. However, in the instance of a single layer insulation consisting of a plastic film metalized on both sides, any defective insulation points can be more easily detected than with the usual resistivity measurement method.

The Measuring and Interpretation of The Voltage Impulses Resulting from Partial Breakdowns in Dielectrics

By H. Gsodam in Elin-Zeitschrift Vol. 13, No. 2, June 1961, pp. 49-60. Original title: Die Messung und Bewertung der von Teilüberschlägen im Dielektrikum herrührenden Impulse. H. Gsodam is with Elin's High Tension Laboratory in Weiz, Austria.

The mechanism of partial breakdowns is described for different classical arrangements. It is pointed out that in solid and liquid dielectrics, the equalization of loading caused by partial breakdowns ensures within 6×10^{-8} till 10^{-9} seconds. The impulses on a needle electrode differ depending on the polarity and deviate from other forms of discharges so that it is not advisable to use needle electrodes to calibrate and test a corona-measuring circuit.

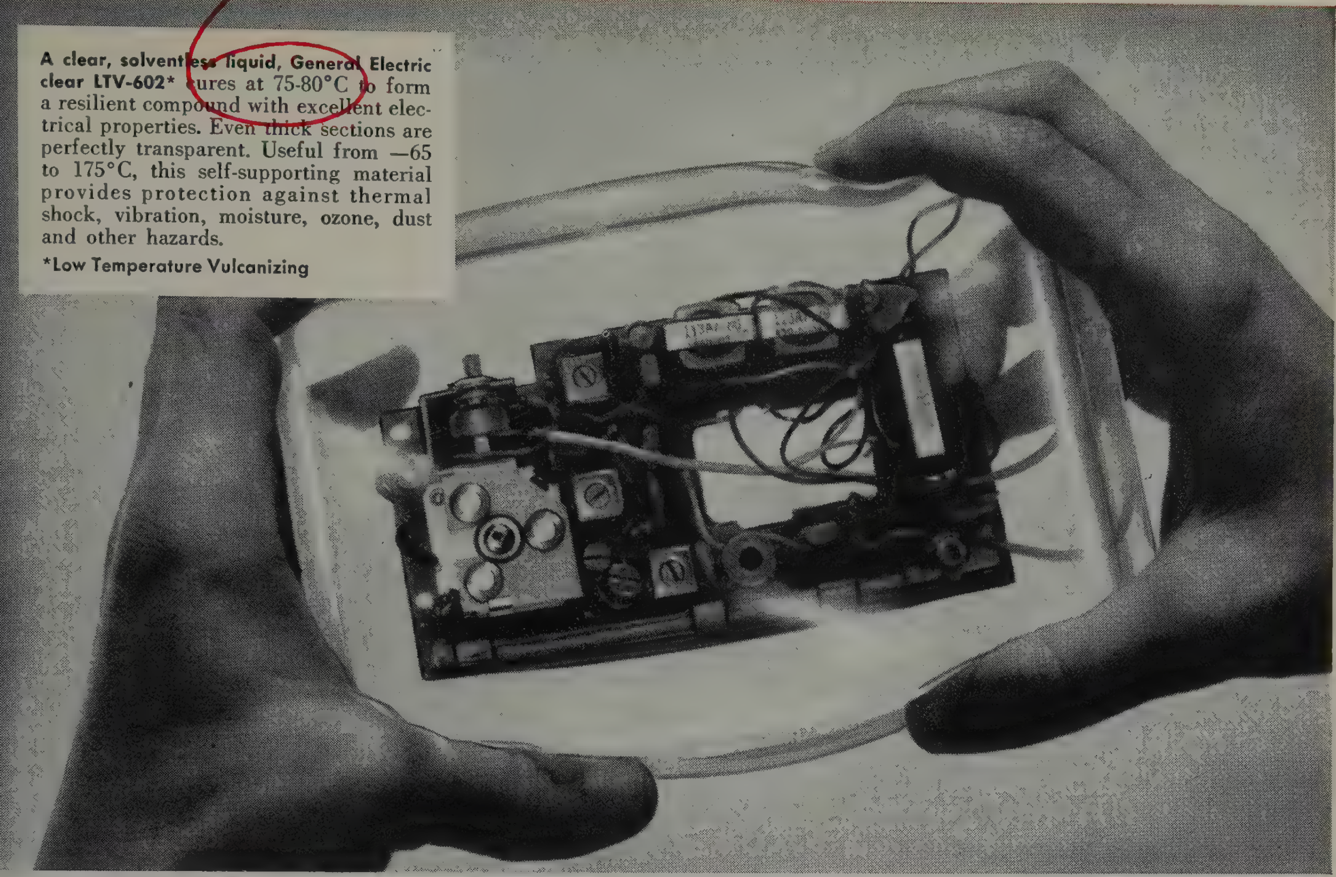
The voltage impulses due to discharges (corona) have to be measured on the terminals of the test object. The best means of selecting these signals from the rated frequency is to use a capacitive—ohmic voltage divider.

An equivalent circuit for the corona

(OR 2 HOURS WITH HEAT)

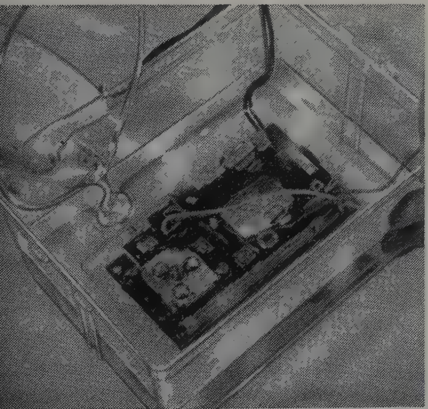
A clear, solventless liquid, General Electric clear LTV-602* cures at 75-80°C to form a resilient compound with excellent electrical properties. Even thick sections are perfectly transparent. Useful from —65 to 175°C, this self-supporting material provides protection against thermal shock, vibration, moisture, ozone, dust and other hazards.

***Low Temperature Vulcanizing**

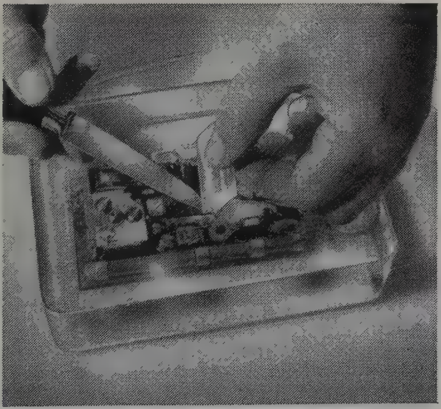


General Electric clear LTV silicone compound for potting and embedding

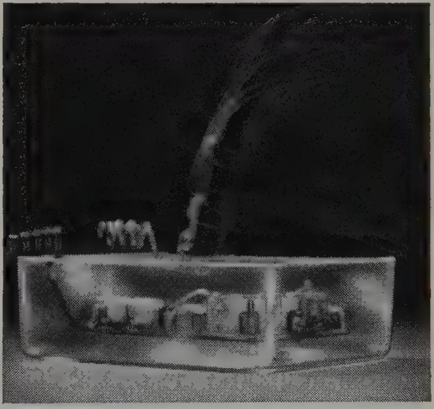
Transparent, resilient, self-supporting and easy to repair



V-602 is easily applied, flows freely in-and-round complicated parts. Having a low vis-osity in the uncured state, 800-1500 centi-oise, LTV is ideal for potting and embedding electronic assemblies. Unlike "gel-like" otting materials, LTV-602 cures to a flex-le solid. Oven cure is overnight, or from to 8 hours at 75 to 80°C.



LTV-602 is easy to work with and easy to repair. To repair parts embedded in LTV, merely cut out and remove section of material, repair or replace defective part, pour fresh LTV into opening and cure. Pot life, with catalyst added, is approximately 8 hours and may be extended with refrigeration. When desirable, LTV may also be cured at room temperature.



Resiliency offers excellent shock resistance. LTV-602 easily meets thermal shock tests described in MIL-STD-202A test condition B which specifies five temperature cycles from —65 to 125°C. Tests indicate that LTV retains protective properties even after 1800 hours aging at 175°C. Other tests confirm LTV's resistance to moisture and water immersion.

CURES IN
IRS – CAN
I USE HEAT
LAMP!

LTV-602 is the newest addition to the broad line of G-E silicone potting and encapsulating materials which also include the RTV silicone rubbers. For more information, write to General Electric Company, Silicone Products Department, Section M1063, Waterford, New York.

3 TIMES FASTE
THAN BEFORE

SEND FOR DATA
ON NEW FAST CUR

GENERAL ELECTRIC

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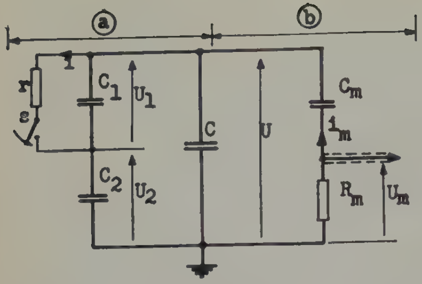

Figure 2, the corona and measuring circuit. Equivalent circuit. a. Test object. b. Measuring circuit.

and the measuring circuit is given. This is valid for the measuring of an insulated and earthed test object (see figure 2).

The author has the opinion that the circuit with an insulated test object has some advantages.

a) If a breakdown occurs on the test object the measuring instrument cannot be damaged.

b) The measuring circuit is of general use.

c) Because of the definitive capacities it is easier to specify a measuring circuit.

He sees the only disadvantage being the necessity of using a corona free high tension condenser. (It seems that he does not consider the cases of installed generators, transformers etc., where the test object absolutely cannot be taken out of its elements and is in this case earthed.)

The form and size of the voltage measured across the resistance is given by

$$U_{m\,\max} = U_1 \frac{C_2}{C} \beta \times e^{-(\gamma 2)\,t}$$

$$\gamma 2 = \frac{1}{R_m \left(\frac{C \times C_m}{C + C_m} \right)}$$

Where β is a factor between 0.8 and 1. From the investigation into what happens when the capacity C_1 has a flashover, causing U_1 and C_2 to become still bigger and C_1 smaller, these interesting conclusions follow:

The heat in the flashover area is probably responsible for the destruction of the dielectric. The opinion of the author is that the magnitude of U_1 gives the dimensions of the cavity at the discharge position and a measurement must give the electric charge flowing through the resistance and the maximum amplitude of the voltage across the measuring resistance to be acceptable.

Besides the electrical charge, the peak value of the impulse should also be measured, since from this it might be possible to ascertain the size of the void. The height and number of impulses, perhaps with different polarities, can also give important information in order to find out the position and type of discharge.

The usual instruments in present day use measure results which are not comparable. However, using a wideband amplifier giving peak and average values, results can be obtained which show the elements responsible for the destruction of material by corona discharge.

Examples of measurements with the NEMA circuit (specification No. 107) are given. Comparison with tan δ measurements shows how unsensitive the tan δ method is. Of course, the NEMA method has also disadvantages (disturbances from other corona points in the laboratory, connections, etc.). It seems that it is possible to take precautions so that a measuring voltage of 500 kV can be reached without passing the ambient interference level of 25 μV.

The Influence of Contamination on Multiple Insulators

By H. Bernhard in Elektrie Vol. 15, No. 4, April 1961, pp. 116-120. Original title: Bündelisolatoren unter Fremdschichteinfluss.

In order to obtain the mechanical strength required today, it is necessary to arrange several strain insulators in parallel. The influence of severe contamination on the flashover voltage of this parallel arrangement is examined.

One imagines the mechanism of flashover on contaminated and humid insulators as follows: on the conducting contamination film on the insulator surface, a current flows drying out and heating certain areas. As a result, the voltage distribution becomes very irregular and conducting current paths and partial breakdowns occur. A total flashover then follows. Another important reason for low flashover voltages is irregularities in the thickness of the contamination film.

The contamination mixture used contained 45% ashes and 25% cement.

The test consisted of four cycles (in Europe eight are usual):

a) Cooling of the test object to 0°C.

b) Humidification in a steam cell until saturation.

c) Contamination in a cell with voltage applied to test object (duration 1 hour, 3.6 kg of contamination dispersed).

d) Cooling to 0°C.

e) A second humidification.

f) High voltage test.

During the voltage test the current in the contamination film and the voltage distribution on the insulator surface were measured. The results show that with small distances between three parallel insulators, the flashover voltage was greatly decreased. The smaller the distances between the parallel insulators and the more irregular is the contamination film, the sooner a total flashover occurs.

Since the normal testing method as used here does not represent real conditions very well, all results were referred to a type of insulator which has been successful in service under exacting conditions.

Thermal Resistance Cables and Conductors Insulated with Butyl

By W. Grabowski in AEG Mitteilungen Vol. 51, No. 3/4 (March/April) 1961, pp. 104-106. Original title: Wärmebeständige Kabel und Leitungen mit Butylgummi als Isolierstoff. W. Grabowski is with Norddeutsche Kraftwerke AG — Berlin-Neukölln (West Berlin).

The article calls special attention to the advantages obtained using butyl rubber instead of natural rubber as insulation for conductors. The main advantage is the possibility of loading butyl rubber insulated cables continuously with 100°C compared with 60°C using natural rubber. An overload of 150°C is allowed for several hours. Due to these advantages an important saving in weight is possible. The German specifications for such cables more or less correspond to the IEC proposals and the Insulated

Power Cable Engineers Association (May 1953) specification.

At first the manufacture of butyl aoutchouc caused difficulties but it s now possible to extrude recently leveloped mixtures directly onto the onductor and vulcanize it evenly. The cover is made of polychloro-outadiene and polychloroprene. This ubber has worse electrical and better nechanical properties than butyl ubber.

Applications are (up to 6 kV nomi-nal voltage) in boiler rooms, machine nstallations, heating installations, eactors outside the nuclear zone, ropical installation, illumination in-stallations (reflectors), ships, rail-ways, mines etc.

New Silicone Resin for Impregnating Cement-Bonded Asbestos Board

Midland Silicones Ltd., England (Associated with Dow Corning, Mid-and Mich.) published in their 'News" and "Preliminary Data Sheet" some data on this material. By impregnation with this new resin t is possible to overcome the usual nigh rate of water absorption with consequent loss of insulating proper-ies of cement-bonded asbestos board.

This material is widely used for arc chutes in air-break switchgear or as spacing insulation in electrical appa-ratus where class C performance is required.

Considerations on the Question of the Adoption of Specifications for Varnished Wire on the Development Of Wire Varnishes

By F. Polenz in Elektrotechnische Zeitschrift part B, Vol. 13, No. 2 anuary 1961 pp. 34-38. Original itle: Gedanken zur Frage der Anpassung der Lackdraht-Normen an lie Entwicklung der Drahtlacke. F. Polenz is a departmental manager with Dr. Kurt Herberts Co., Wupper-al-Barmen, West Germany.

The author gives a very good sum-mary of the present USA specifica-ions on copper wire. He criticizes the German specifications of 1943 on the grounds that they are out of date and e proposes that these specifications e changed and the USA specifica-ons adopted.

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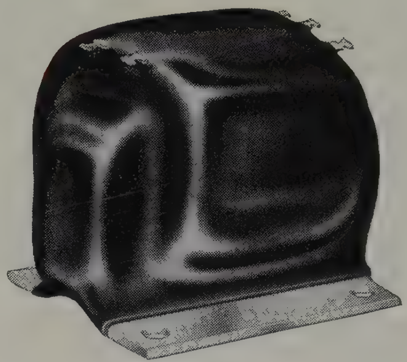

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HARCURE A imparts toughness, flexibility and good electrical properties to a fluidized bed coating formula-tion ... is an excellent flexibilizer for epoxy tapes.

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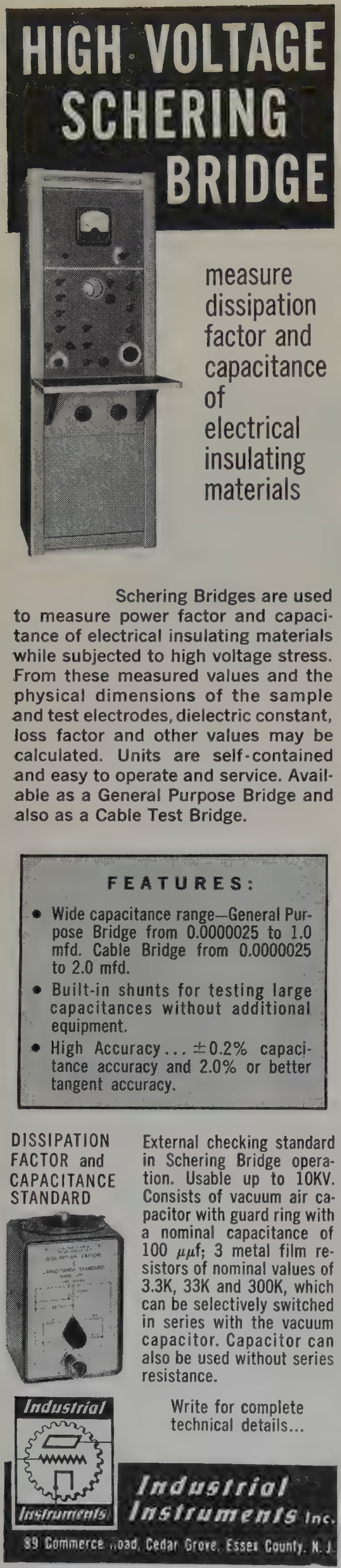

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measure dissipation factor and capacitance of electrical insulating materials

Schering Bridges are used to measure power factor and capacitance of electrical insulating materials while subjected to high voltage stress. From these measured values and the physical dimensions of the sample and test electrodes, dielectric constant, loss factor and other values may be calculated. Units are self-contained and easy to operate and service. Available as a General Purpose Bridge and also as a Cable Test Bridge.

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- Wide capacitance range—General Purpose Bridge from 0.0000025 to 1.0 mfd. Cable Bridge from 0.0000025 to 2.0 mfd.
- Built-in shunts for testing large capacitances without additional equipment.
- High Accuracy . . . ±0.2% capacitance accuracy and 2.0% or better tangent accuracy.

DISSIPATION FACTOR and CAPACITANCE STANDARD

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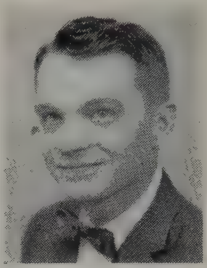
Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What do you think can and should be done to improve reliability of insulation systems in industrial, military, and consumer electrical/electronic products?



R. N. Sampson

Supervising Engineer, Materials Laboratories, Insulation and Chemical Dept., Chemical Application Section, Westinghouse Electric Corp., East Pittsburgh, Pa.

"The use of insulation systems with high reliability is of interest to every electrical product manufacturer. In order to obtain maximum reliability for any system, at least three elements are required.

1) The first of these elements is the existence of carefully established standards which define electrical systems, material properties, and test procedures. In the United States, the materials engineer has access to excellent standards which are prepared by technical societies such as AIEE, NEMA, ASTM, SPI, and certain Governmental organizations.

2) The second essential element for reliability is in the exact definition by the designer of the requirements of a proposed insulation system as related to the available specifications. The designer must then cooperate with materials engineers in order to choose the insulation system which best meets the definitions.

3) Having carefully designed the electrical apparatus, the third step in obtaining maximum reliability is an exhaustive, scientifically performed, functional evaluation of the newly created apparatus in order to predict the performance, limitations, and life of the electrical device in question."

Irving Brown

Quality Control Engineer, Coil Winders Inc., Plainview, L. I., N.Y.

"Recognition of the fact that common failures of equipment are due to insulation failures enables us to more readily supply electronic equipments to Government or commercial customers with better reliability against insulation failures.

"With better understanding of equipments, components used in the equipments, and conditions under which they will be used, a step-by-step analysis should be used in selecting suitable insulating materials to be used.

"The analysis should indicate the proper insulating materials which would stand up under the following conditions which are recognized as prime reasons for insulation failures: Contamination; moisture absorption; thermal aging; expansion and contraction; mechanical damage due to shock, vibration, stress, etc.; and capabilities to handle over-voltages and excess currents due to short circuits."

S. A. Hluchan

Development Engineer, Instrument Div., Bourns Inc., Riverside, Calif.

"The insulation requirements of many basic primary measuring ele-

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Essex Magnet Wires produced for the hermetic motor industry are an example of the complete wire line developed specifically for your applications. There is a "right wire" for you in the full Essex line.

Enamel Class 105C	Formvar and Hermetic Formvar Class 105C	Acrylic Class 105C	Modified Formvar Class 105C	Self-Bonding Formvar Class 105C	Nylon Class 105C	Formvar-Nylon Comb. Class 105C	Urethane Class 105C	Non Slipping Urethane Class 105C	Urethane-Nylon Comb. Class 130C	Self-Bonding Urethane Class 105C	Epoxy Class 130C	Mod. Polyester Class 155C	Silicone Class 180C	ML* Class 220C
Plain or Black Enamel	Formvar	Acrylex	Formetex	Bondex	Nylon	Nylform	Soderex	Gripex	Soderon	Soderbond Soderbond N	Epoxy	Poly-Thermalex Nytherm Thermalex F	Silicone	[illegible]

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A urethane modified Formvar wire developed for the hermetic motor industry. This construction offers improved chemical stability in R12 and R22 refrigerants, plus greater resistance to thermoplastic flow when compared to unmodified Formvar. This has been accomplished without sacrifice of the characteristics associated with the vinyl acetal wires. Available in round wire sizes AWG 12 thru 27 in single, heavy and triple builds and in shaped wire up to 100,000 square mil cross section.

ACRYLEX®
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A magnet wire enameled with DuPont Lecton. This chemically resistant film offers the hermetic motor manufacturer a low extractable rugged film coated wire accepted for usage in R12 and R22. Acrylex is available in sizes AWG 15 thru 30 in single and heavy builds.

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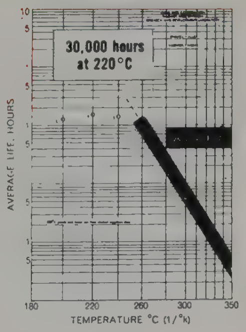
Laboratory data predicts a promising future for Allex in hermetic systems. This thermally stable conductor offers unlimited potential with its unmatched chemical stability and thermal resistance. Available in sizes AWG 8 thru 46 single and heavy films and in shaped wire up to 100,000 square mil cross section.



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ments, control devices, and interconnecting leads utilized in electrical and electronic circuits for nuclear radiation environments are quite satisfactorily met for low and also, in many instances, for high level fluxes. In the latter case, the use of inorganic materials such as ceramics and boron-free fiber glass is accompanied by certain mechanical disadvantages, i.e., bulkiness, lack of flexibility, pressure seals problems, etc. As a rough rule of thumb, the higher the temperature rating of the material, the more radiation resistant it is. There is a large range of applications of materials for intermediate range of flux levels for which common materials are of marginal or unknown utility. The limits of useability are very uncertain because of lack of experimental radiation damage information, questions regarding the composition and the presence of neutron sensitive impurities in the raw material, and possibly incomplete information about the nature and intensity of radiation environment to be encountered.

"The technology of radiation damage studies is not on an engineering basis, and some basic understanding of nuclear terminology, materials, and fundamental processes, and also a detailed knowledge of the chemical composition and the function of the materials used in a component for nuclear environments, is necessary to enable the supplier to provide a suitable product to the ultimate user. The information available is scattered among many sources (much of it is classified), and the variables and data are expressed in different forms and a variety of units. A basic problem of understanding requirements and communication exists between users and suppliers. The former lacks knowledge of the materials composition of the desired product and the latter lacks understanding of the unusual service conditions to be encountered. Several exchanges of information by correspondence may be required for a successful product application.

"The major definitive terms necessary to describe a radiation environment are: Type of radiation (gamma or neutron only of interest in most cases); the energy distribution spectrum of each constituent; the intensity or flux field; and finally, the time of exposure. If the values of the above variables are not within certain limits there are aggravating associated effects, as for example, for high flux rates: self heating, photoconductivity, accelerated decomposition and gas evolution, activation, etc. Also, certain ambient conditions at the sample, such as higher temperature, accelerate radiation damage. The terms given above describe incident radiation field; however, the energy actually absorbed in the exposed material and the interaction effects resulting can only be ascertained by reference to experimental work.

"There is no simple way of applying radiation fields and material interaction effects data and information to all types of matter and for all applications. Therefore, particularly for intermediate life expectancy insulation, the ultimate user of the material for nuclear service should supply brief explanatory information and literature references to the supplier, and should also inquire regarding the chemical composition of the product materials and their primary function in the product. Several interchanges of data from the supplier of information may be necessary to determine its life and behavior in the application. The changes in irradiated materials may not always interfere with their primary function in the product.

"This note has been written to point out the need for quick reference, standardized nomenclature, units, conversion factors, processes, materials damage, transient phenomena data and literature reference sheets for industrial engineering personnel having no, or only occasional contact with atomic energy applications."

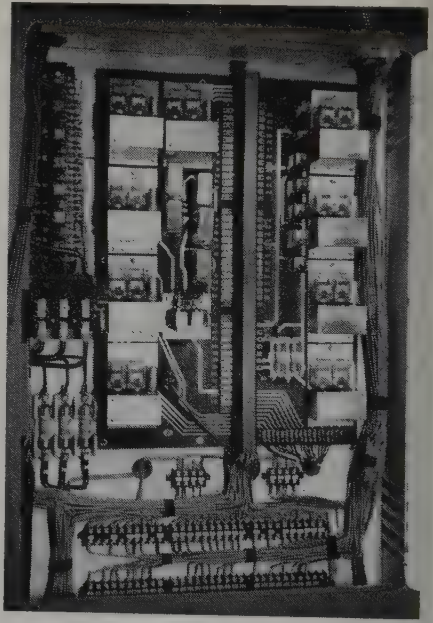
A. Gross

Chief Engineer, Electronics Div., Cleveland Metal Specialties Co., Cleveland, Ohio.

"Now that enough experience has been gained in the use of printed circuits for military, industrial, and consumer products, more diversification is needed in combining wired interconnections to printed circuits.

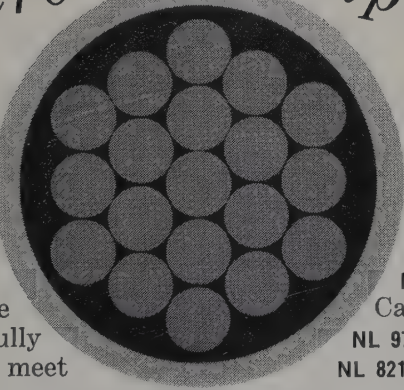
"Electric wire insulation is also a heat insulator. Heat created by the flow of current through the conductor is held captive and not readily dissipated, therefore large conductors are needed to offset this temperature rise.

"In printed circuits the copper conductor is flat and laminated to its supporting base insulator, exposing one side to open air. This permits more area of the copper conductor to radiate heat, and its supporting base insulator also aids in cooling. The amount of copper needed to carry the current is minimized and at a saving in space occupied by the conductor. The illustration shows a power control panel for a sequence timer of a huge plastic injection molding machine in which the printed circuit has been set up to handle 220 volts a-c at 30 amperes. This is just one of many examples of the 'marriage' of power wiring and printed circuits.



"New and improved laminated base insulating materials, capable of working at higher temperatures, will reduce the amount of copper needed in the conductors of an electric or electronic system using printed circuits."

Nelco coated wire stands up to the elements



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That's what makes Nelco lacquers he *lacquers with a difference*. They're ot just "mixed" — they're carefully *ormulated* to make certain they'll meet our strictest specifications.

Of our hundreds of stock formulations for wire nd cable coating, we've listed a few here. With ur unique facilities we can *custom* formulate still thers to meet special requirements.

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Look at this array of lacquers. High temperature resistant. Clear, glossy film. Flame retardant. Fray prevention. MIL spec. finishes. Fungus resistant.

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NL 8223 Nelco Clear Heat Resistant Cable Coating

NL 9731 Nelco Flame Retardant Saturant

NL 8211 Nelco Moisture Resistant Saturant

NL 9776 Nelco Clear Cellulose Acetate Cable Coating

R 4026 Nelco High Temperature Resistant Cable Coating

R 5979 Nelco Clear Nylon Cable Coating

R 6625 Nelco Ribbon Cable Adhesive

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Heated Die Stamps Out Printed Circuit Pattern, Establishes Bond Between Adhesive-Coated Copper and Base Material

By Bernard Gould, Rubber and Asbestos Corp., Bloomfield, N. J. All photos courtesy Rubber and Asbestos Corp.

Comparatively new in the field of "printed wiring," die stamped circuits have achieved rapid acceptance and appear to be gaining favor in the home appliance industry, electronics, instrumentation, and similar fields where large-scale mass production warrants their use. Die stamped circuits, which are licensed under patents of Resources and Facilities Corp., New York, employ a heated metal cutting die which not only stamps out the conductive pattern, but establishes the bond between the copper foil and the baseboard material. Since this method is mechanical, uniformity and more accurate duplication of the circuit pattern is said to result.

The Ucinite Co., Division of United-Carr Fastener Corp., Newtonville, Mass., were pioneers in the research and development of many products incorporating die stamped circuits. As specialists in electromechanics, their work integrates the basic fabrication of stamped circuits with the design, manufacture, and subsequent assembly of hardware.

Prior to their specialization in stamped circuitry, Ucinite had used conventional etched circuits. It was during that period that they first adopted the use of copper sheets precoated with adhesive as a basic raw material.

The pre-coated copper, trade-named "Plymaster" and manufactured by our firm, was originally developed for the production of *etched* printed circuits and is currently in use throughout the world for this process. The copper sheets used for this purpose are cut to size, pre-cleaned, preinspected for surface defects, adhesive-coated, dried to a non-tacky condition, and inspected for uniformity of adhesive coverage . . . all before they are shipped to the printed circuit manufacturer. Thus, these six production steps are eliminated and the circuit producer need only lay the adhesive-coated copper sheet on the baseboard material and then cure in a heated press for approximately 30 minutes to effect the final lamination.

With the advent of stamped circuitry, however, new formulating technology was required for the adhesive coating on the copper since the stamping process involves a hot die dwell time of only about 2 to 10 seconds in place of the half-hour used for curing the adhesive in the etched circuit process.

In addition, one of the major advantages in the production of die stamped circuits lies in the method's adaptability to high-speed, low-cost mechanized mass production. For this type of production, the cut-to-size sheets, which represent a time and labor saving in etched circuit manufacture, would actually hinder smooth production flow. Accordingly, to

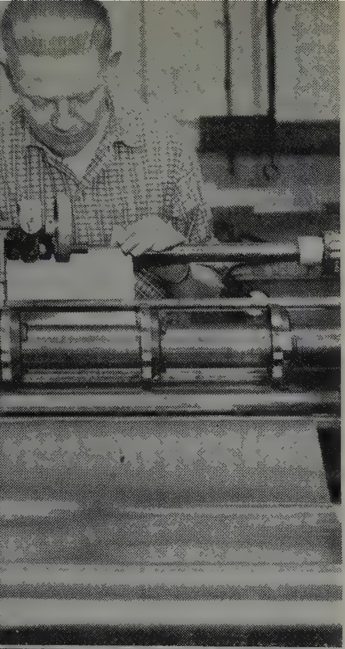

Figure 1 (top left), 36″ wide roll of adhesive-coated copper, which has been coated with a special adhesive formulation for die stamped circuit use, is slit to the same width as the baseboard material to which it will be bonded.

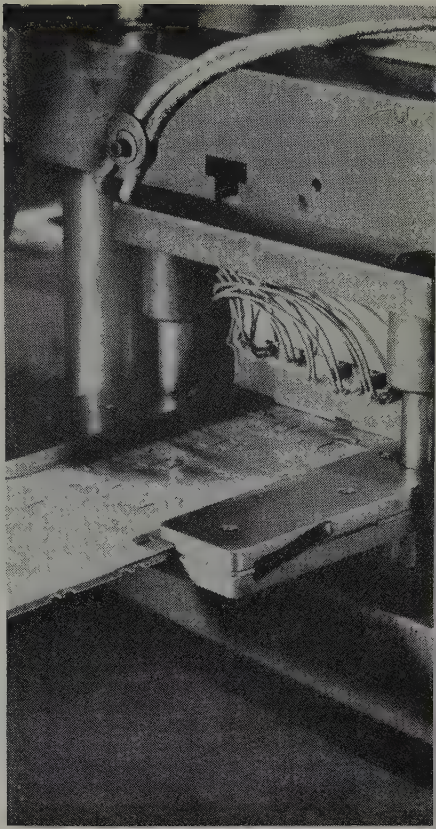

Figure 4 (top right), boards move out of the embossing press after the circuits have been stamped with the adhesive-coated copper simultaneously bonded to the baseboard by the hot dies.

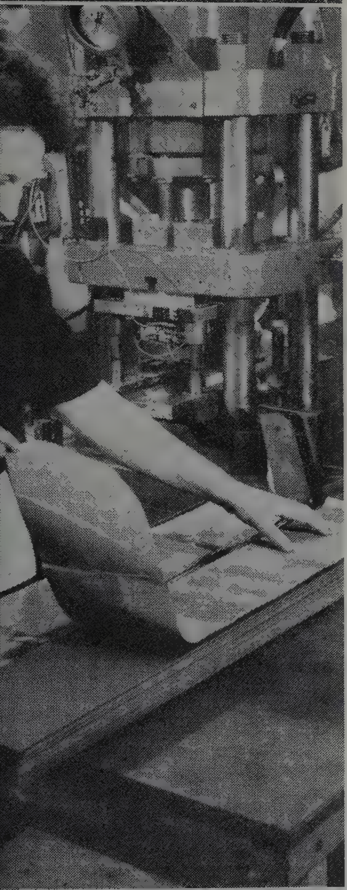

Figure 2 (middle left), the slit adhesive-coated copper, which has been cut to the same length as the baseboard, is laid in place.

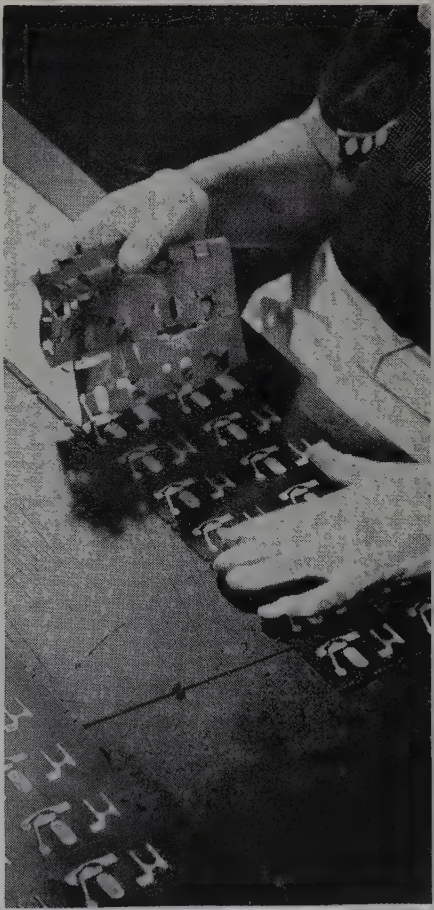

Figure 5 (middle right), excess copper is stripped from the baseboard, leaving the series of finished circuit patterns.

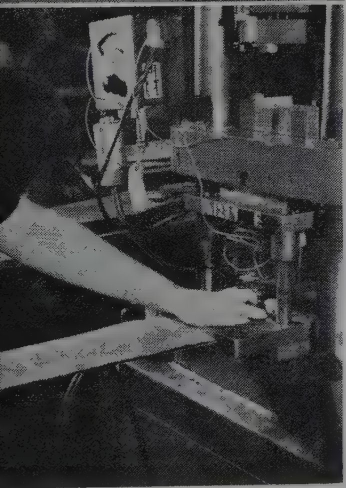

Figure 3 (bottom left), the baseboard, with adhesive-coated copper on top, is fed into the embossing press.

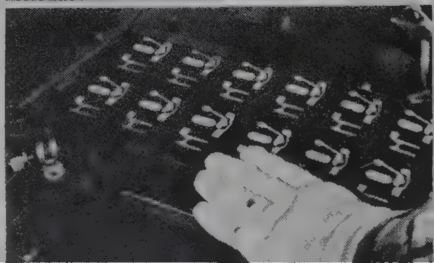

Figure 6 (bottom right), after pre-heating, the boards are placed in machine which pierces and blanks out the circuits.

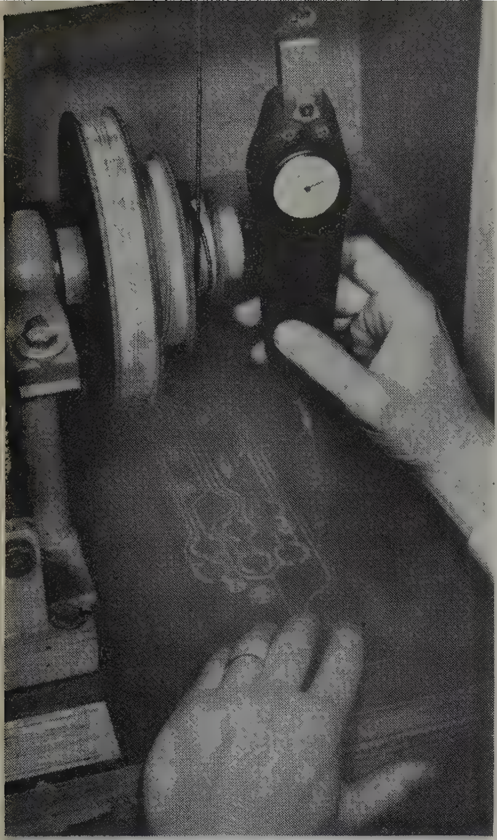

Figure 7 (top), completed circuit board is tested for bond strength.

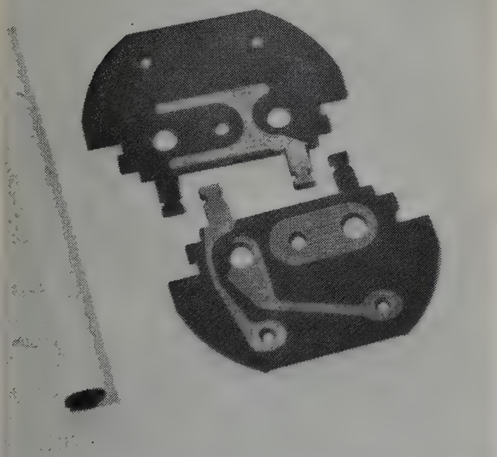

Figure 8 (middle), a finished die stamped circuit used on auto instrument panel gauge.

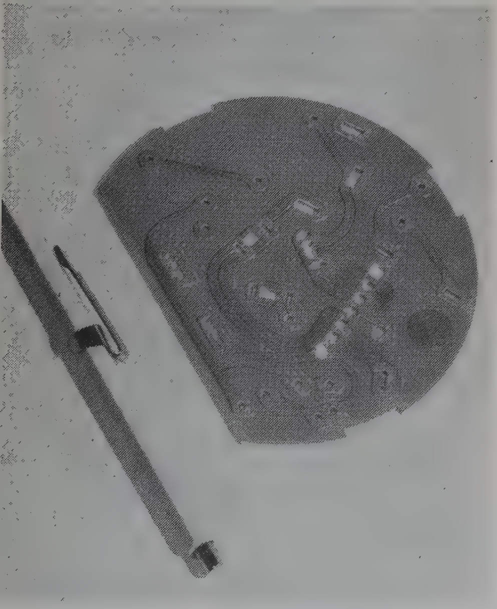

Figure 9 (bottom), finished die stamped circuit used for photoelectric outdoor lighting control.

achieve the most efficient and economical production of stamped circuits, it was necessary to provide adhesive-coated copper which could be shipped to the user in roll form (usually 1,000 feet long for 1-ounce copper and 500 feet long for 2-ounce copper) without the danger of the coated material blocking in transit or storage.

Another important advantage claimed for this system lies in its ability to utilize a far wider variety of baseboard and conductor materials than is possible with etched printed circuits. This, in turn, demanded the development of new types of adhesive-coated copper which can produce high-strength bonds to such materials as thermoplastic and thermosetting molded housings, yet achieve the peel strength and, where applicable, the solder dip resistance required by these circuits. Today, the wide variety of baseboards currently employed in the die stamping process include: ABS (acrylonitrile butadiene styrene) polymer, phenolic, epoxy paper, and melamine surface laminates, as well as other materials.

Typical production steps in the manufacture of the high precision die stamped circuits at Ucinite start with the slitting of the 36″ wide adhesive-coated copper rolls into narrower coil widths to conform to the size of the baseboard material used in the processing operations (figure 1).

Subsequent to slitting, the rolls are rapidly sent through a desired plating bath.

The boards, with the adhesive-coated copper laid on top (figure 2), are then fed into the embossing press where the hot dies simultaneously bond and stamp the circuit pattern to the baseboards (figures 3 and 4).

Generally, a number of circuits are produced on each piece of standard-size baseboard material. After embossing, the excess copper is stripped from the baseboard, leaving the finished circuit patterns (figure 5). Following this, the boards are pierced and blanked to desired customer specifications (figure 6).

As shown in figure 7, random circuit boards from each production lot are spot-checked for bond strength.

nderground residential distribution
able is terminated in this backyard
ansformer compartment. The cable, in-
ulated with BAKELITE polyethylene,
as made by Rome Cable Division of
lcoa, Rome, N. Y.

In Elk Grove Village, a suburb of Chicago, the developer worked out an economical arrangement with Commonwealth Edison Company to eliminate all of the power poles in this subdivision. This was accomplished by direct burial of the power distribution cable.

15-Kv cable, insulated with BAKELITE polyethylene, was used on the 7200/12470 system. It was buried directly in the ground at a depth of 36" . . . to assure trouble-free service and improve appearance.

BAKELITE polyethylene insulation has proved to be a tough and dependable performer. It's highly resistant to moisture and cracking . . . an excellent low-loss dielectric above ground, or below it. Lightweight, rugged polyethylene insulated-jacketed cable can stand up to rough handling during aerial or underground installation.

Want more information about BAKELITE insulation and jacketing for more reliable electric service? Write Dept. **KD-75J,** Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

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Print Ins. 2 on Reader Service Card

HERE'S NEWS ABOUT ANACONDA ML FILM-COATED MAGNET WIRE FOR 220 C

Affords continuous high-temperature operation up to 250 C—resists heat shock up to 425 C

The exceptional heat stability of Anaconda ML Magnet Wire makes it ideal for electrical equipment operating at continuous high temperatures up to 250 C—such as high-temperature motors, relays and dry-type transformers. This same heat-resistant characteristic also makes ML Magnet Wire a valuable tool in miniaturization and in reducing the size of larger equipment.

Tremendous overload resistance (as demonstrated by thermo-plastic flow above 500 C and heat shock resistance over 400 C) makes ML Magnet Wire particularly suitable for portable tool armatures and other applications where "stall" conditions or unusual overloads may be experienced.

Essentially zero weight loss to 200 C makes it possible to use ML Magnet Wire for relays that will operate at temperatures up to 250 C with low space factor and comparatively low cost. Using ML Magnet Wire in sealed relays practically eliminates contact contamination due to "outgassing" of wire insulation.

Other ML Magnet Wire advantages: high burn-out resistance and cut-through level; dry dielectric strength over 3,000 V/Mil; excellent flexibility; good windability and scrape resistance.

ML Magnet Wire is coated with a solution of ML Polymer, a new chemical development by duPont that represents a tremendous improvement in heat resistance over organic coatings. ML Magnet Wire can be used as a replacement for most film-coated magnet wires, except solderable types, and many glass and glass Dacron wires. Where the positive inorganic spacing of glass is required, the combination of ML film and glass serving offers outstanding properties. ML Magnet Wire's combination of high temperature rating, excellent winding characteristics and space factor permits its use in many applications which formerly required the use of much more expensive combinations of ceramics and fluorocarbons.

ML Magnet Wire is available in all sizes of round, square and rectangular. Film additions are single, heavy, triple or quadruple thicknesses, all conforming with NEMA specifications. ML also meets all requirements of Spec. MIL-W-583B for Class 180 Types H, H2, H3, and H4, and Class 200 Types K, K2, K3, and K4. For prices, technical data and applications engineering information, contact Department EFL-1-I, Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York.

ASK THE MAN FROM
ANACONDA®
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Print Ins. 3 on Reader Service Card

Insulation for a Radiation Environment: Part 1—Inorganics

By Arthur Bradley, Director of Research, Radiation Research Corp., Westbury, L.I., N.Y.

With the exception of vacuum, all dielectrics are subject to some modification of their electrical resistance in a radiation field. This usually takes the form of increased volume conductivity due to electronic excitation. With prolonged exposure, however, chemical or physical changes in the material may affect the magnitude of this radiation-enhanced ("induced") conductivity, resulting in either an apparent improvement or deterioration of the insulation resistance with time. These conductivity changes may take place independently of the gross radiation damage effects that lead to structural failure.[1]

In evaluating a material for use as an insulator in a radiation field it is important to consider

(a) the background conductivity in the absence of radiation, and its relation to temperature, ambient humidity, and total dose;

(b) the magnitude of induced conductivity (σ^*) and its dependence on the radiation level (R), usually described in terms of the exponent Δ in the expression[2]

$$\sigma^* \;\alpha\; R^{\Delta} \qquad (1)$$

(c) the changes in σ^* with total dose absorbed; and

(d) the lifetime structural dose.

This paper describes the experimental approach and results obtained in a study of these effects in some common inorganic insulators. A similar report on a group of organic polymers will follow in an early issue of *Insulation.*

EXPERIMENTAL

Two distinct operations were performed on each material involving radiation. These consisted of (a) measuring electrical conductivity under Kr^{85} beta excitation, and (b) exposing samples to a high energy electron beam to accumulate dosage.

A list of the materials included in this investigation with supplier's names, physical properties, and a summary of induced conductivity data, is given in table 1.

Induced Conductivity Measurements

The special source-electrode assemblies used in these measurements were described previously.[3, 4] Excitation was provided by ampoules of krypton gas containing 5% Kr^{85}. Suitable radiation levels were provided by varying the gas pressure among different ampoules. The thin window of the beta source was mounted in close proximity to the samples; the weakest gave about 10^4 rads/hr, the strongest about 5×10^4 rads/hr. The area of sample irradiated for the induced conductivity measurements was about 1.0 cm^2.

Specimens were flat disks, 1.5 to 2.0 in. in diameter and 0.001-0.012 in. thick. The electrodes were circles 0.63 in. in diameter centered opposite each other on either face. Dark conductivities were therefore calculated on the basis of 0.31 $in.^2$ (2.0 cm^2) electrode area, as opposed to 1.0 cm^2 for induced conductivity. The electrodes were aluminum, applied by evaporation, and were of negligible thickness. A guard ring (1.0 in. ID, 1.38 in. OD) surrounded the electrode on each side to eliminate surface conductivity.

An example is presented of a typical conductivity measurement. With sample S in place in one of the source-electrode holders, and 1200 V applied across the electrodes, the shutter in front of the thin window of the Kr^{85} ampoule was opened, exposing the sample to the beta flux. The current flowing in the external circuit connecting the electrodes reached equilibrium at 33 $\mu\mu$A (33 x 10^{-12} amps). When the applied voltage was reversed, the stable current measured was 17 $\mu\mu$A, and when no external voltage was applied (electrodes shorted through the electrometer) the intermediate value of 25 $\mu\mu$A was observed. The last figure is the beta transmission current,[4] from which the dose rate to the sample can be calculated.[5]

Assuming a thickness of 0.0127 cm, the conductivity of specimen S can be determined from equation 2 (a= 1 cm^2).

$$\sigma = \frac{\Delta I}{\Delta V} \times \frac{l}{a} = \frac{16 \times 10^{-12} \times 0.0127}{2400} \qquad (2)$$

$$= 8.5 \times 10^{-17} \text{ mho/cm}$$

For conductivity measurements at 65°C, the source electrode assemblies were mounted inside a large oven with rough thermostat control of the temperature (±2°). The two electrode leads from each apparatus extended through the oven wall, one to a chemical battery pack and the other to an electrometer.

Measurements at room temperature were carried out in a bell jar swept with a dry nitrogen atmosphere to suppress background conductivity due to humidity. Measurements at 150°C were in a small oven with a special source holder in which only "Teflon" insulation was employed.

Electron Beam Radiation

Massive doses in the range of 10^8 to 2×10^{11} rads were applied with the "Dynamitron" accelerator (Radiation Dynamics Inc., Westbury, New York). A beam energy of approximately 0.9 Mev was used for all irradiations. The dose rate was varied by adjusting the beam current (0.4-6ma) and the distance of the samples from the beam window.

For the lower dose rates ($\sim 10^8$ rads/hr) the specimens were mounted in packets of about 200 mg/cm^2 thickness between aluminum slats having appropriate win-

Table 1—Description of Materials Investigated

Material	Supplier	Thick., cm Avg. Sample	Density mg/cm^3	2 x 10^4 rads/hr Typical σ*, 65°	See Fig.
Fused Silica, SiO_2 ("Synthetic Quartz")	(a) Corning stock ground by Valpey(1)	0.020			1, 2
	(b) Thermal Amer.(2)	0.030	2.2	5×10^{-15} (6) 1.5×10^{-16} (8)	
("Natural Quartz")	Thermal American	0.025			2
Glass, "Rad. Resistant"	Corning 1723	0.016	2.6	2×10^{-17}	8
Capac. Ribbon	Corning 8871	0.008	—	3×10^{-17}	
Alumina, 98% Al_2O_3	Commercial stock ground by Zenith (3)	0.025	2.9	—	
Boron Nitride, BN	Carborundum Corp.	0.018	2.1	1×10^{-15}	
Mica, Natural Crystal	Reliance (4)	0.008	2.8	2×10^{-17}	5
Mica, Synthetic Crystal	Synthetic Mica Corp.	0.016	2.7	8×10^{-17} (6) 2×10^{-15} (7) 3×10^{-17} (8)	3, 4 3, 4 4, 8
Reconstituted Mica Paper					
Natural	Samica (5)	.007	1.8	7×10^{-17}	7
Synthetic	Synthetic Mica Corp.	.018	1.9	7×10^{-17}	7
Mica Mat., Silicone Impr.	General Electric 77875	.007	1.3	5×10^{-17}	6
(same, Glass bonded)	General Electric 77873	.008	1.0	5×10^{-17}	6

1) Valpey Crystal Corp., Holliston, Mass.
2) Thermal American Fused Quartz Co., Dover, N.J.
3) Zenith Optical Laboratories, Copiague, N.Y.
4) Reliance Mica Corp., Brooklyn, N.Y.
5) Samica Corp., Rutland, Vt.
6) Before electron beam irradiation
7) Highest σ (10^7 rads)*
8) After maximum radiation improvement

dows so that each packet could be cooled by forced air at both front and back faces. For the higher dose rate levels (10^9 to 10^{10} rads/hr) the specimens were packed to less than 100 mg/cm^2 and backed by a water cooled brass block.

Dosimetry at the lower levels was carried out with indicating tape (PVC) calibrated by RDI personnel by comparison with a known radiation source. For the exposures to 6×10^9 rads and higher, a Faraday cup was used to collect a known portion of the beam at various points in the sample area. A map of the beam current was constructed and a dose rate level assigned to each specimen thereby.

In one experiment at the highest radiation rate employed (6×10^9 rads/hour), considerable heating occurred despite the water-cooled support. This led to fracture of some fragile specimens and possibly contributed to the magnitude of the radiation effect in the other materials. In this run the samples were mounted in a straight line only 3.5 in. from the beam tube window of the Dynamitron. At this distance the effective height of the beam was 11.5 in. The plot of Faraday cup currents measured just prior to this irradiation is given in figure 10 as an example of the dosimetry technique.

Figures 11, 12, and 13 are photographs of the irradiation equipment.

RESULTS AND DISCUSSION

This report emphasizes electrical conductivity under radiation as the principal functional characteristic of insulators to be considered for use in a nuclear environment. Induced conductivity data is presented in the same units used for ordinary or "background" electrical conductivity (mho/cm), except that the excitation dose-rate must be specified. It must also be clear at what temperature the measurements were carried out, although in general induced conductivity is less sensitive to temperature changes than background conductivity.

In this section the background conductivities and humidity effects are discussed first, followed by a description of the physical effects of an accumulated radiation dose. Particular note is made of one irradiation at high temperature, in which the rate of structural damage to mica appeared to be accelerated. Finally, the induced conductivity data is presented for the individual insulating materials in a series of nine figures. A summary comparison of all materials is given in figure 9.

Background Conductivities

At 65°C most of the materials had background conductivities below 10^{-17} mho/cm. This includes natural and synthetic mica crystal, silicas, and glasses. No attempt was made to record accurate data in that region, which was negligible compared to induced conductivities found at 10^4 rads/hr and above. The only materials having significant background conductivities at 65°C were alumina and certain mica compositions, and with the latter this could be attributed to traces of moisture retained by the porous construction.

The volume conductivity of alumina was a sensitive function of both temperature and humidity. The lowest value observed, at 25°C in a dry atmosphere, was 4×10^{-16} mho/cm. This was larger than the induced conductivity at 10^4 rads/hr. The latter did not tend to change very rapidly with temperature, but the background conductivity was up two orders of magnitude at 65°C and two more at 150°C (see table 2). At 25°C in air saturated with moisture, $\sigma = 10^{-13}$. These values were not appreciably altered by irradiation to 10^{10} rads.

Reconstituted papers of both natural and synthetic mica are porous by nature and their background conductivities are exponential functions of relative humidity.[3] Thus at 25°C, a typical specimen gave a negligible ($<10^{-17}$) conductivity at RH = 0; $\sigma = 10^{-15}$ at 10% RH; and $\sigma = 10^{-12}$ at 30% RH. Such moisture response in new samples was duplicated in those that had received 10^8 to 10^9 rads, but the behavior changed markedly thereafter (see below). All induced conductivity data presented for these materals was taken under dry atmosphere conditions. This was achieved at 65°C without special treatment by allowing the sample to equilibrate in the oven for 1-3 days before taking measurements under Kr^{85} beta excitation.

Physical Effects of High Radiation Doses

Specimens of General Electric silicone-impregnated Mica Mats began to lose their moisture-resistant properties in the range of 10^9-10^{10} rads, whereupon their background conductivities (symbolized as σ_0 wherever confusion with induced conductivity, σ^* might occur) rose considerably and became acutely sensitive to traces of humidity. The σ^* values obtained from Mica Mats up to 10^9 rads and σ_0 thereafter (at 65°C, less than 2% RH) are plotted in figure 6. These Mica Mat samples failed physically at the lowest level; all other materials tested were as good as in their original condition or better after 10^{11} rads at approximately room temperature.

Color changes gave the first visual indication of radiation effects in most materials. Alumina, natural mica crystal, and the Mica Mats turned brown where irradiated, and it was observed that this color effect was intensified when accompanied by overheating. Fused silicas showed variable patterns of discoloration in the 10^8-10^{10} rad region, usually with purple hues. The photograph of the top center specimen in figure 14 gives some indication of the appearance of these color patterns.

Corning 1723 glass and synthetic mica crystal remained clear and transparent after 10^{11} rads, indistinguishable in outward appearance from unexposed samples. The highly irradiated and overheated synthetic mica specimen shown at the top right in figure 15 had some burned areas which did not affect the electrical conductivity. They may have been caused by the decomposition of some other less radiation resistant material in the same specimen packet.

Effects of Overheating Specimens at High Dose Rates

In one of the two highest level irradiations, the temperature was estimated to have risen as high as 150°C. Positioned near the beam center (figure 10), natural mica

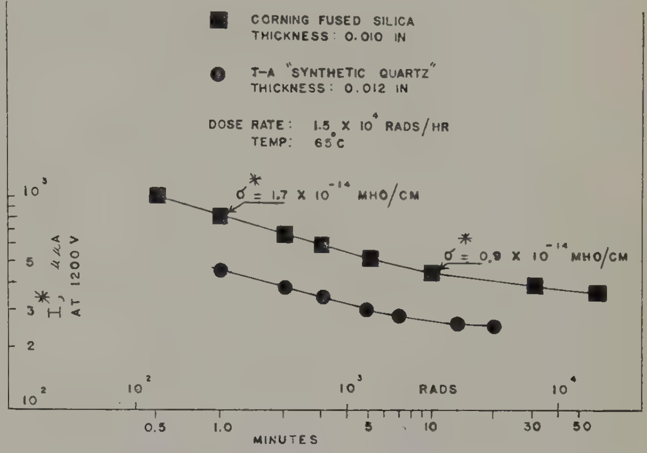

Figure 1, initial effect of dose on induced current ($I_C{}^*$) in fused silicas.

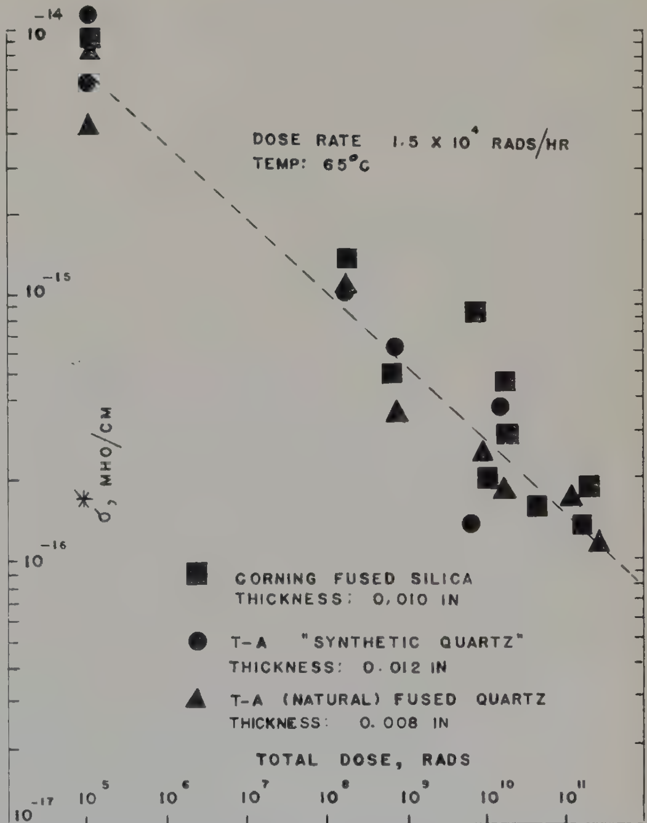

Figure 2, induced conductivity (σ^*) of fused silicas as a function of total dose.

and various mica compositions received dosages of 1.6 × 10^{11} rads. All of these were destroyed, and mica traces were found throughout the sample holder. Referring to figure 10, a natural mica crystal specimen in position 6 was limp and torn, with no cohesive strength remaining. It tended to separate into a multitude of fragments via delamination followed by collapse of the fragile flakes. This specimen appears in the lower right of the photograph, figure 15. The reconstituted mica papers in position 4 (synthetic) and 5 (natural) were almost completely disintegrated, the remnants scattered and unrecognizable. The same was observed with the Mica Mat in position 7.

Glass fiber supported Mica Mats had been exposed on the outer fringes of this irradiation, in positions 1 and 9, receiving only 1 to 5 × 10^{10} rads. In both specimens the network of glass fibers remained, but the interstices, originally filled with silicone resin and mica pulp, were largely empty (see photograph, figure 14). It was expected from the loss of moisture resistance after about 10^{10} rads that the silicone impregnant was relatively sensitive, but the failure of the mica filler at this level was surprising. It may be that the decomposition of the silicone tended to accelerate the damage rate to the mica with which it was intimately compounded. It is significant that a natural mica crystal specimen in position 2 (about 0.5 × 10^{11} rads) was physically intact and suffered no electrical damage.

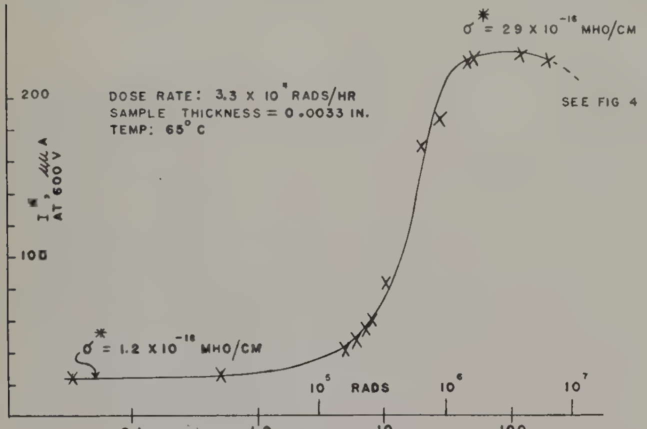

Figure 3, initial effect of dose on induced current (I_σ) in synthetic mica crystal.*

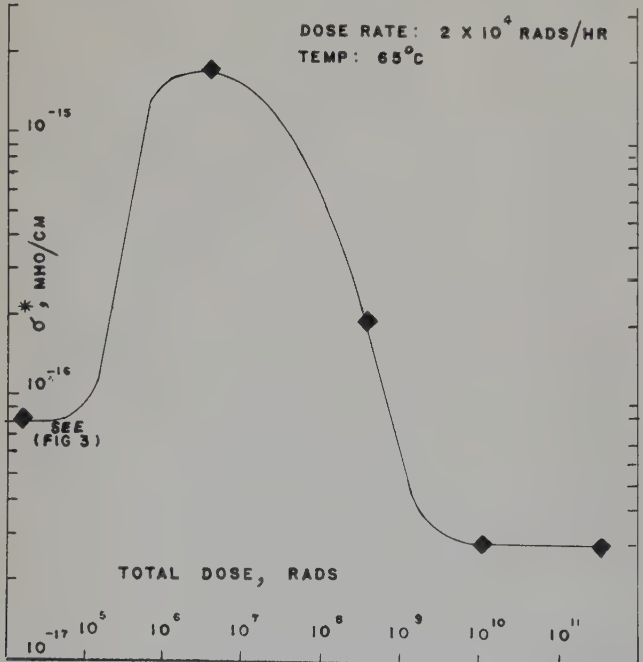

Figure 4, induced conductivity (σ) of synthetic mica crystal as a function of total dose.*

The synthetic mica crystal specimen in position 3 had separated into two thinner pieces. It was stained but not electrically damaged, although it received the highest total dose: 2.4 × 10^{11} rads according to the dosimetry pattern (figure 10). This was the only variety of mica that showed no general discoloration at any level of dose or heating.

Samples of single crystal quartz, alumina, and Corning 1723 glass broke at positions 3, 5, and 7, respectively. Placing the fragments together indicated that, in general, breakage had occurred before discoloration. Charred areas on the fragments due to decomposition of less radiation-resistant materials did not fit into an over-all pattern when the samples were reconstructed. The breakage, therefore, occurred early in the experiment, and was related to overheating or to an intense dose-rate effect (as opposed to an accumulated dose). Since the similar specimens withstood the same dose-rate without breaking under better cooling conditions, there is a strong presumption that overheating was the critical factor.

Physically, several layers of aluminum foil covered the specimens and held them in place during the irradiation. This metal foil became very hot and expanded, possibly causing enough strain on the fragile disks to cause them to fracture. Note, however, that fused silica did not fracture. The four equally fragile silica specimens at positions 4, 6, 8, and 9 remained intact. It is difficult to say whether the specimens broke due to heat alone, due to combination heat and radiation, or due to distortion of the sample holder. The survival of the four silica specimens would tend to eliminate the last possibility.

Effects of Radiation On Electrical Conductivity

Induced conductivities (σ*) at 2 × 10^4 rads/hr (65° C) ranged from 2 × 10^{-17} mho/cm for natural mica and Corning 1723 glass to 10^{-14} for fresh samples of fused silica. In general, a characteristic σ* value could be assigned to each type of material, regardless of the source of supply or particular thickness of the specimens or the way they were prepared for testing. Moreover, this characteristic σ* frequently remained unchanged throughout several cycles of beam irradiation (approximately 10^8, 10^9, 10^{10}, 10^{11} rads).

Although integrated dose did not influence σ* for most materials, there were two noteworthy exceptions. The simplest case was fused silica, which started to show decreased nduced conductivity in the very earliest stages of irradiation (figure 1). This trend continued, and most specimens showed an overall insulation improvement, after 10^{11} rads, of nearly two orders of magnitude. All σ^* values for silicas have been normalized to 2×10^4 rads/hr and plotted as a log log function of total absorbed dose in figure 2.

The improvement trend in the experimental points for the silica specimens in figures 1 and 2 followed approximately straight lines on the log log plots. The slopes of these lines corresponded to a decrease in σ^* by nearly one-half for every decade of radiation dose accumulated. At the highest irradiation levels, the average insulation resistance of silica was inferior to that of mica and Corning 1723 glass by less than an order of magnitude. There was very little difference between specimens identified as "fused quartz" and "fused silica" (figure 2). The effects of trace impurities, then, were not primarily responsible for the radiation-improvement, which must be explained in terms of the amorphous structure common to all varieties of silica.

It can be assumed that the invasion of high speed electrons breaks many silicon-oxygen bonds.[6] They may then reform with a different arrangement of atoms in which there is more strain, and there may be an increased number of free valencies where atoms are displaced out of position to recombine. It is suggested that these strained or permanently broken bonds interfere with the transfer of charge through the structure.

A more explicit discussion of this radiation improvement effect is not justified without a better understanding of the mechanisms which cause induced conductivity. It may be mentioned, however, that a related effect in thin single crystals of magnesium oxide (tenfold reduction in "bombardment" current after neutron irradiation) was similarly attributed to reduced carrier lifetime due to traps at newly created lattice defect centers.[7]

The other changes in σ^* with dose observed in this investigation were with synthetic crystal mica. Fresh specimens increased rapidly in σ^* at 3×10^4 rads/hr (Kr^{85} beta excitation, figure 3), reached a maximum of about 10^7 rads, and dropped nearly back to the natural mica level after 2×10^9 rads (figure 4). The behavior of the material was truly unique, and should be capable of much more detailed elucidation than the relatively simple effect in fused silica. Evidently a series of structural changes occurred which passed through an intermediate highly conducive to charge transfer.

The observed electrical properties of synthetic mica crystal in the final stages of irradiation were not dissimilar to those of natural mica. This might suggest that the former had been converted physically and chemically to the latter, except that the natural material retained a greater sensitivity to radiation and heat.

The most extraordinary feature of synthetic mica crystal was that at the peak σ^* level about 10^7 rads it showed a pronounced negative temperature coefficient for this parameter. This is a characteristic generally found only in metals where the number of carriers is fixed and thermal

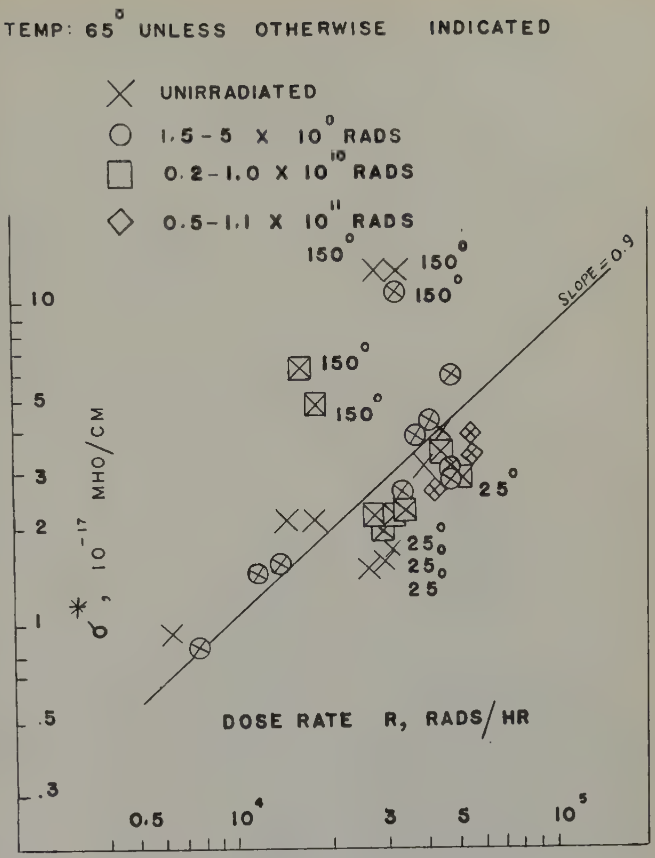

Figure 5, induced conductivity (σ^*) vs dose rate for natural mica crystal.

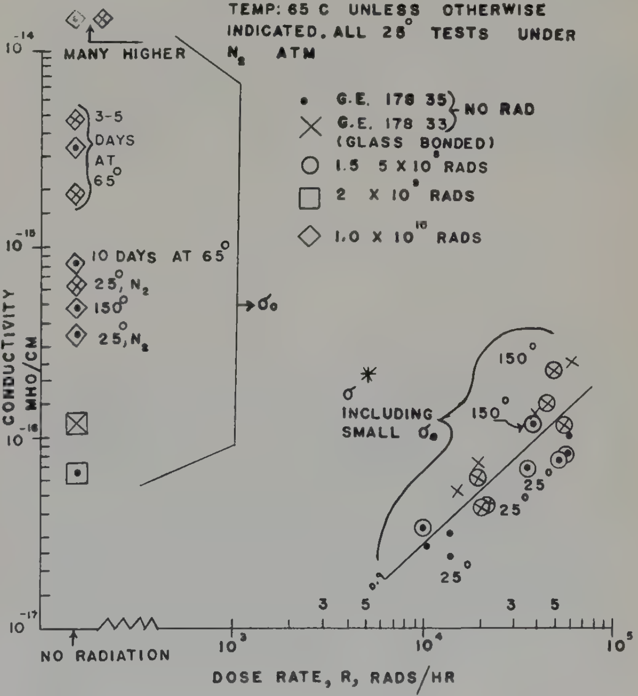

Figure 6, induced (σ^*) and background (σ_0) conductivities for silicone-impregnated mica mats, showing increase in (σ_0) after 10^4 rads.

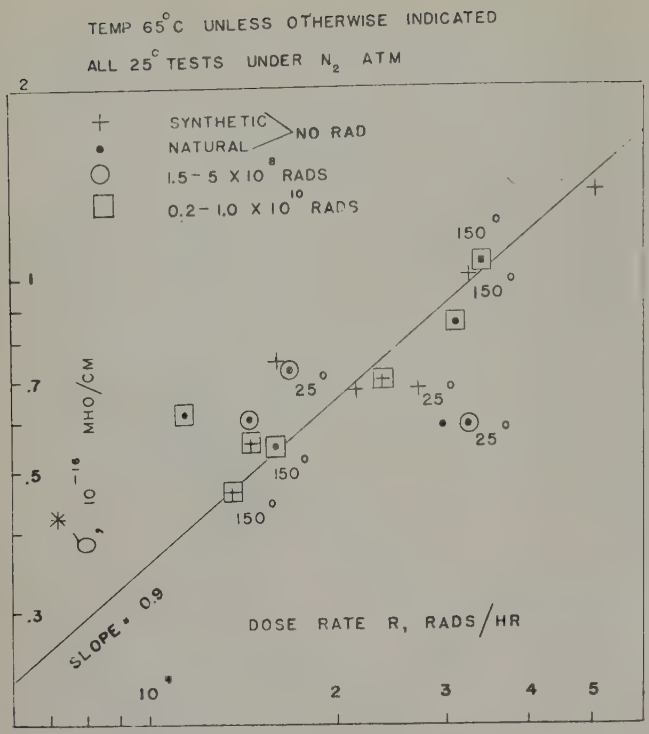

Figure 7, induced conductivity (σ) vs dose rate for reconstituted mica papers.*

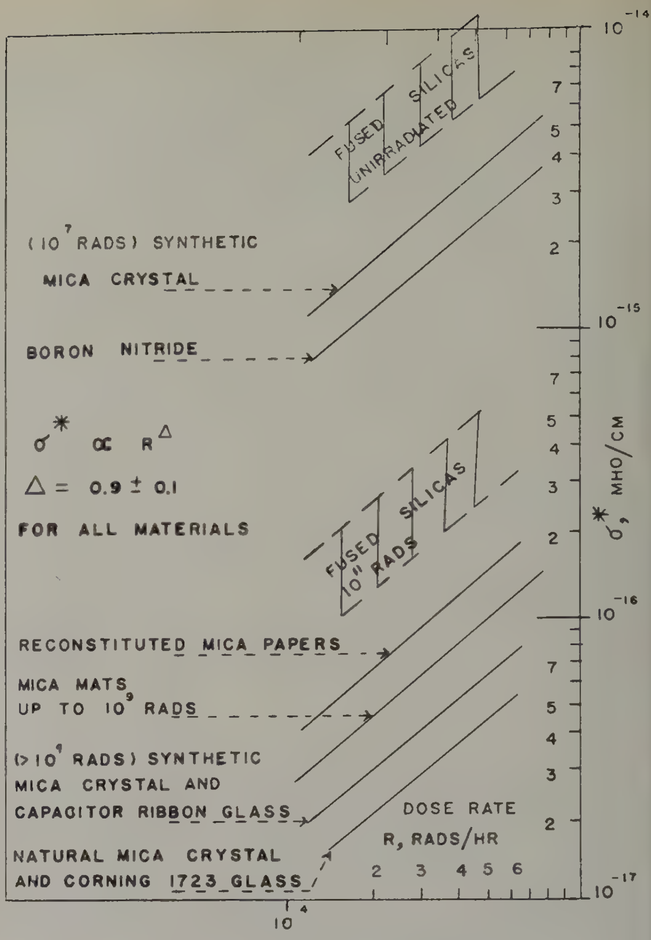

Figure 9, summary: induced conductivities (σ) of inorganic insulators vs dose rate.*

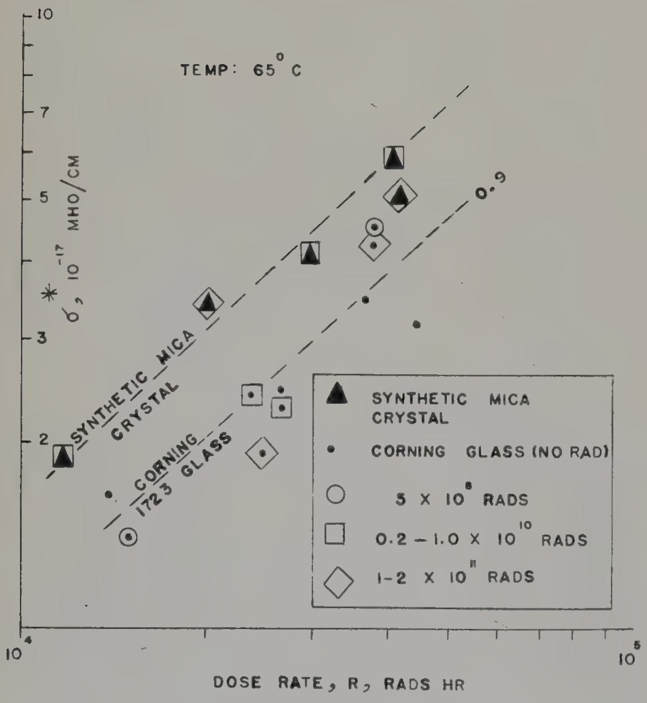

Figure 8, induced conductivities (σ) vs dose rate for synthetic mica crystal 10⁹rads) and Corning 1723 glass*

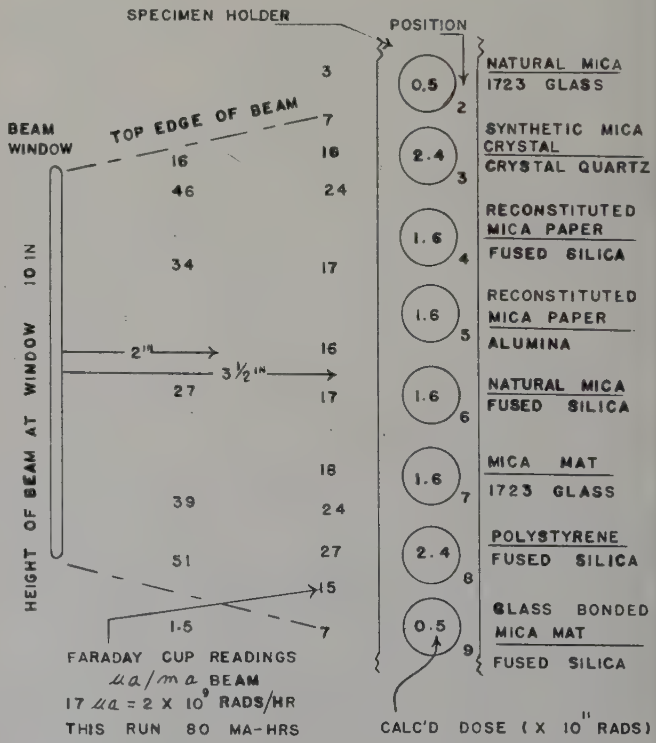

Figure 10, dosimetry and specimen placement for electron beam irradiation (high temperature exposure).

agitation of the atoms only serves to interfere with the mobility. It would be of exceeding interest to study this phenomenon in greater detail.

Induced Conductivity Data

Multiple samples of each material were subjected to the series of irradiations and tested for σ^* (after each exposure) at several excitation levels. As described above, the experimental results for fused silica and synthetic mica crystal, showing the changes in σ^* during irradiation exposures, are given in figures 1 through 4. For all other materials, which showed no changes in σ^* with dose, it was more convenient to present the data as a series of plots of log σ^* vs log R (excitation dose rate).

The group of materials consisting of natural mica and various mica compositions was quite stable to irradiation. The conclusion that the σ^* of natural mica did not change with accumulated dose was based on a comparison of over 30 measurements (figure 5); the same for silicone-impregnated Mica Mats is shown in figure 6 and for reconstituted mica papers in figure 7.

It will be observed that in figure 6 both plain and glass fiber supported Mica Mat specimens gave essentially the same values of σ^* until they both began to deteriorate in moisture resistance at about 10^9 rads. Thus the glass fiber composition did not change either the electrical properties or the radiation stability of the material.

It is perhaps more surprising that reconstituted papers of either natural or synthetic mica (and from different suppliers!) could not be distinguished from each other on the basis of induced conductivity or stability to electron beam damage. This would suggest that the unusual radiation response of synthetic mica crystal may be a function of its bulk physical state rather than its chemical composition.

The various glass and ceramic specimens were not particularly affected electrically by their exposure to the electron beam. Figure 8 gives the experimental points for 1723 glass and highly irradiated synthetic mica crystal. The summary in figure 9 includes, in addition, capacitor ribbon glass, boron nitride, and the intermediate (10^7 rad) stage of synthetic mica crystal. A straight line slope of 0.9 was assumed for these materials although each had too few experimental points available to determine this factor accurately.

Alumina has not been included in the summary chart of σ^* data (figure 9) because its background conductivity is high compared to the other materials tested. No changes were observed in its electrical properties after 10^{11} rads.

By contrast, the other ceramic, boron nitride, had comparatively low background at 65°C, but appreciable induced conductivity. An accumulated dose of approximately 10^9 rads caused no change in σ_0 or σ^* for boron nitride, but higher irradiation levels could not be achieved because of handling difficulties brought about by the fragility of this material in thin sections. The background and induced conductivities of alumina, boron nitride, and (for comparison) natural mica crystal at several temperatures are presented in table 2.

Table 2—Conductivity Data for Ceramics (mho/cm)[a]

	Alumina	Boron Nitride	Natl. Mica
σ_0 (25°)	4×10^{-16}	....	10^{-18}
σ_0 (65°)	6×10^{-14}	5×10^{-17}	6×10^{-18}
σ_0 (150°)	7×10^{-12}	10^{-15}	1.2×10^{-16}
σ^*(25°)	6×10^{-16}	....	7×10^{-18}
σ^*(65°)	6×10^{-14}	10^{-15}	1.3×10^{-17}
σ^*(150°)	7×10^{-12}	2×10^{-15}	1.3×10^{-16}

(a) Induced conductivity (σ^*) values measured at approximately 2×10^4 rads/hr (includes σ_0).

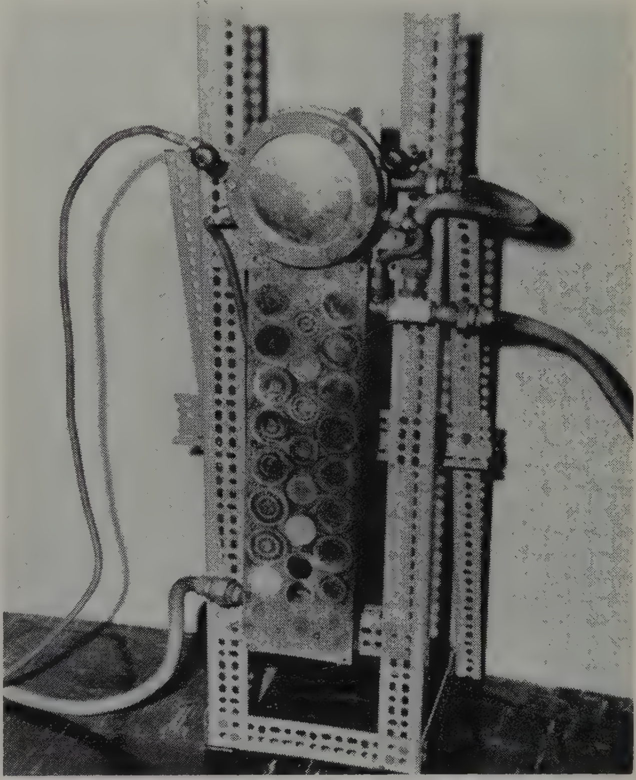

Figure 11, specimen holder used in 6 x 10^9 and 1.5 x 10^{10} rad exposures, showing cooling system and round chamber (top) for controlled atmosphere. Specimens have been removed but shadows of electrodes remain on the metal.

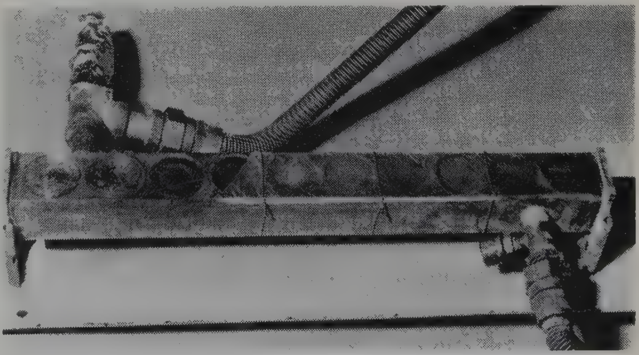

Figure 12, specimen holder used in 1.5 x 10^{11} rad exposure, showing how aluminum foil was held in place by wire. Mica specimens in positions 3 and 4.

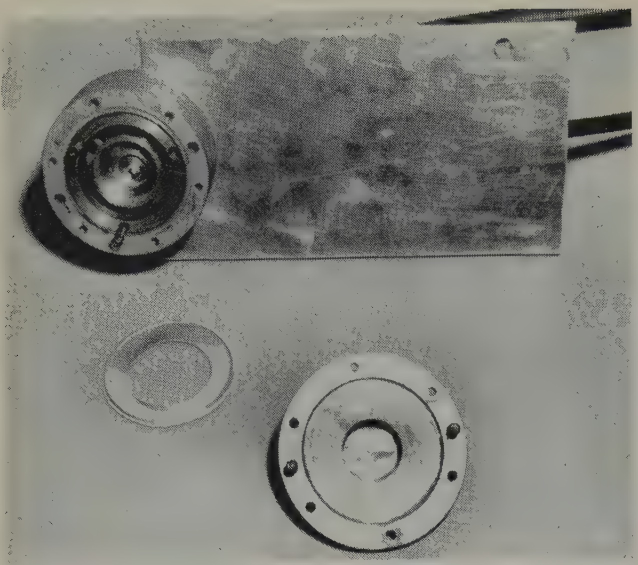

Figure 13, Faraday cup used for dosimetry, showing metal O-ring seal.

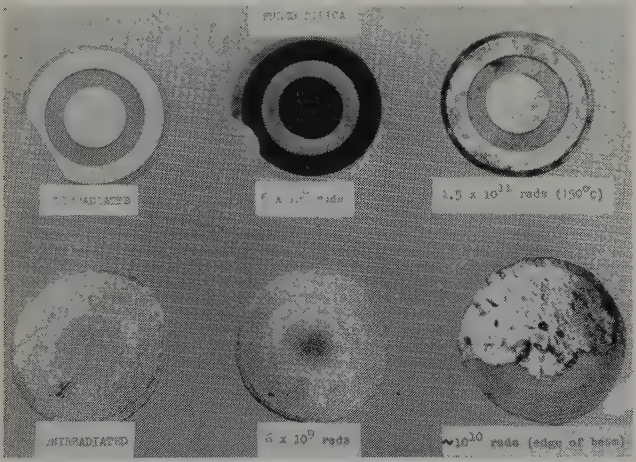

Figure 14, glass bonded mica mat.

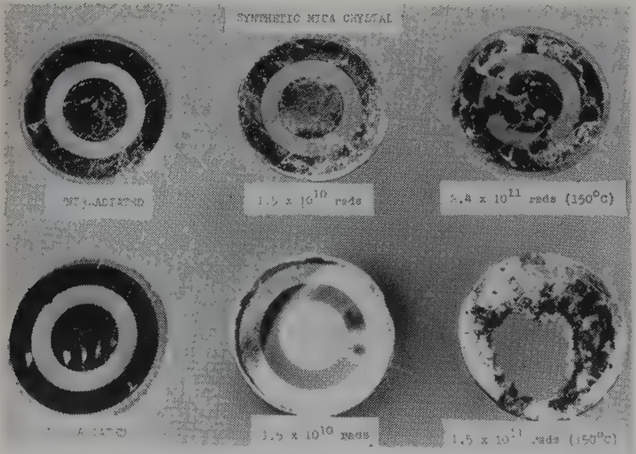

Figure 15, natural mica crystal.

The experimental data as presented in figures 5 throug 9 comprise a series of log log plots of induced conductivity vs dose rate (R), the latter being easily derived from the beta current (I_β) measured in the sample at zero applied voltage. As previously described,[5] the relationship between R and I_β can be determined from equation 2.

$$R = \frac{\mu\, E_{ave}\, I_\beta}{\mu\mu A}$$

(a = irradiated area = 1 cm², 1_β in $\mu\mu$a), using the approximation that beta absorption can be described in terms of an exponential function with the same absorption constant (M) for all materials. With Kr^{85} excitation, $R = 2.2\ I_\beta \times 10^4$ rads/hr.

The slope of the best straight line fitting any set of points in figures 5 through 8 represents the experimentally determined Δ exponent (Eq. 1) for that material. It has been found in this investigation that $\Delta = 0.9 \pm 0.1$ for all these inorganic insulators. This is consistent with data in the literature for mica[2] and fused quartz.[8]

The assembled conductivity vs dose rate data for all insulators constitute a family of lines of slope 0.9 in figure 9 where σ^* values at all excitation levels between 10^4 and 10^5 rads/hr can be compared. Typical conductivities at 2×10^4 rads/hr (center of experimental range) are included for convenience in table 1.

Some basic questions are raised by these results which cannot yet be answered. Why do some materials have higher induced conductivities than others? Why do some change under irradiation and others remain the same? Why does silica improve according to a log log (hyperbolic) relationship? What happens to synthetic mica crystal in the first 10^6 to 10^7 rads, which then reverses itself in the next few decades of dose, and why doesn't it happen to natural mica? Can the unusual electrical properties of the intermediate be exploited in a useful device? It is hoped that some progress toward the clarification of all these problems will be achieved in the next phase of this investigation.

ACKNOWLEDGMENTS

Invaluable technical assistance was provided by Mr. Edward A. St. John. The author is also indebted to Dr. Stanley Grand and Mr. Arthur P. Pinkerton for advice and helpful discussions. Mr. Pinkerton is largely responsible for the design of the specimen holders for irradiation and for the Faraday cup dosimetry.

SUMMARY

Of those materials tested, the lowest induced conductivities in the range of 10^4 to 10^5 rads/hr were Corning 1723 glass, natural mica, and synthetic mica crystal which had been irradiated to at least 6×10^9 rads. All these had σ^* between 10^{-17} and 10^{-16} mho/cm at this level of beta excitation. The same materials were also found to be in good condition after 10^{11} rads, and relatively insensitive to the effects of humidity and temperature.

Synthetic mica crystal, undamaged physically or electrically at 2.4×10^{11} rads, may be the best insulating material for a nuclear environment. However, it should

probably be pre-irradiated, since it was observed to pass through a temporary stage of high induced conductivity in the range of 10^5-10^9 rads. This material is exceptionally stable to the combined effects of heat and high radiation dose. It also aroused great interest due to its negative temperature coefficient of induced conductivity prior to electron beam irradiation.

Four types of mica compositions had low induced conductivities, but their background conductivities were something of a problem unless the humidity was carefully controlled. An undesirable radiation effect observed in the range of 10^9-10^{10} rads was the destruction of the silicone-impregnant in the two G-E Mica Mats, with corresponding loss of all moisture protection. When irradiated to about 10^{10} rads at 150°, the mica filler in the Mica Mats and in the reconstituted mica papers was decomposed or dispersed as mica flakes and dust. Even natural mica crystal did not survive intact after 10^{11} rads at elevated temperature.

Fused silica, like 1723 glass and mica crystal, had low background conducitvity, even in a humid environment. The induced conductivity of fresh specimens was high, but decreased from nearly 10^{-14} to 1.5×10^{-16} mho/cm (2×10^4 rads/hr) after a total absorbed dose of 10^{11} rads. On a plot of log σ^* vs log of total dose the experimental points approximately fitted a straight line, the slope of which indicated that σ^* was halved with each decade of radiation dose. The best samples of radiation-improved silica had σ^* values only about 5 to 10 times greater than those of mica or 1723 glass at the equivalent excitation dose rate. The radiation effect on fused silica has been discussed as an example of lattice defect interference with charge transfer in an amorphous solid.

The background conductivity of alumina was high and markedly dependent on both temperature and humidity. Even under the most favorable conditions employed in this investigation (room temperature, negligible humidity), the induced-current increments were small compared to the dark currents.

The σ^* levels of boron nitride were high, compared to alumina, but the background currents were relatively minor. Neither the boron nitride nor the alumina changed in electrical properties with radiation. These ceramic materials might be chosen over mica, glass, or silica on the basis of cost, convenience in fabrication, or high temperature stability, without suffering too much loss in insulation properties or radiation resistance.

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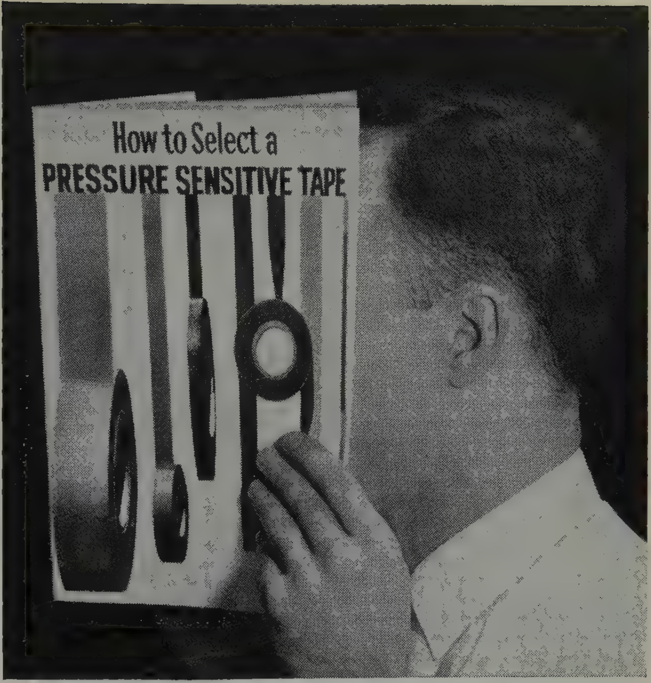

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Painting in background: "The Piping Shepherd," by Sir Joshua Reynolds, P. R. A. (1723–1792)

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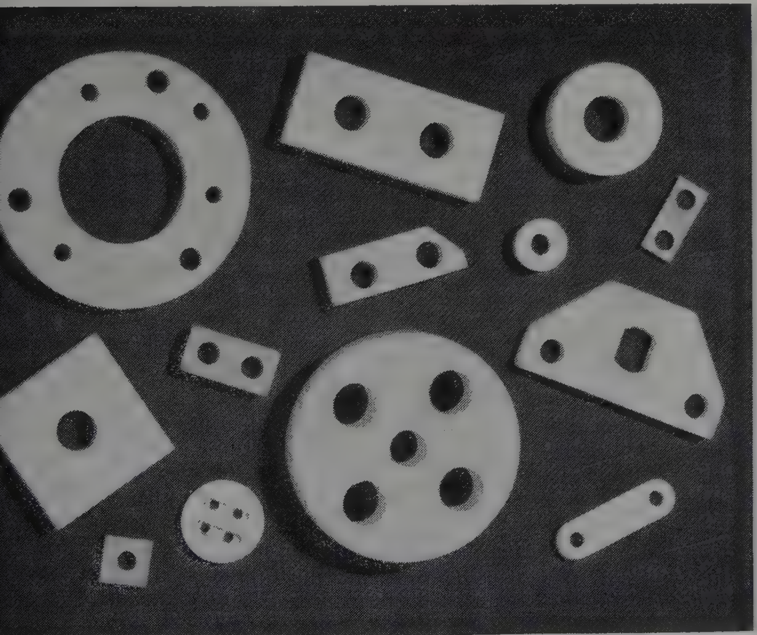

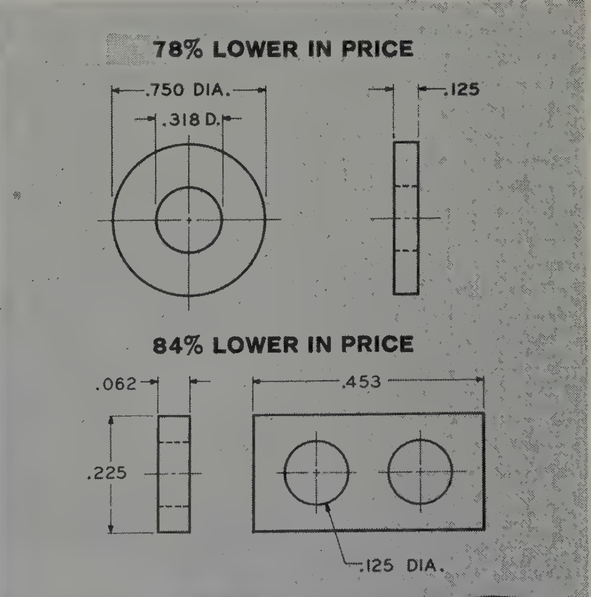

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Spot-Check Reveals Positive and Negative Aspects Of Utility Usage of Polyethylene Coated Cable

By John Lachmann, Application Engineer, U.S. Industrial Chemicals Co., New York.

Twenty eastern and midwestern electric utilities look for increasing use of polyethylene-coated cable in utility distribution systems.

The opinions of these utilities, as expressed by their distribution engineers and line superintendents in a recent spot-check, possibly indicate that a major share of the estimated $60-million earmarked for electric utility purchase of distribution-system cable in 1961 will be spent on products coated with polyethylene.

Since only 20 utilities were interviewed, it certainly would not be valid to project the results so as to apply to the entire industry — however, the findings are interesting.

The spot-check found that 19 of the 20 companies reached were using poly-coated wire in their overhead distribution systems, and that the only dissenting company was about to begin using it. The most prevalent use was for service drop, although about half of the companies indicated that they use poly-coated wire in all three parts of their distribution networks — primary (mostly spacer-type installations), and secondary, as well as service drop.

Of the 20 utilities' distribution system experts checked, 15 felt that poly-coated wire will have as long or longer service life than wire coated with other materials. Three even expressed belief that this service life might well average 25 years. All indicated, however, that accumulated experience with poly-coated wire — about 5 years, in most cases — was not sufficient to give unqualified support to this expectation.

The most frequently-mentioned advantage (16 mentions) of poly-coated wire was its lower cost as compared with wire coated with other materials. Comments on this ranged from "Initial price is the determining factor in purchase," to "The long range economy afforded by poly-coated wire is far more important than initial savings."

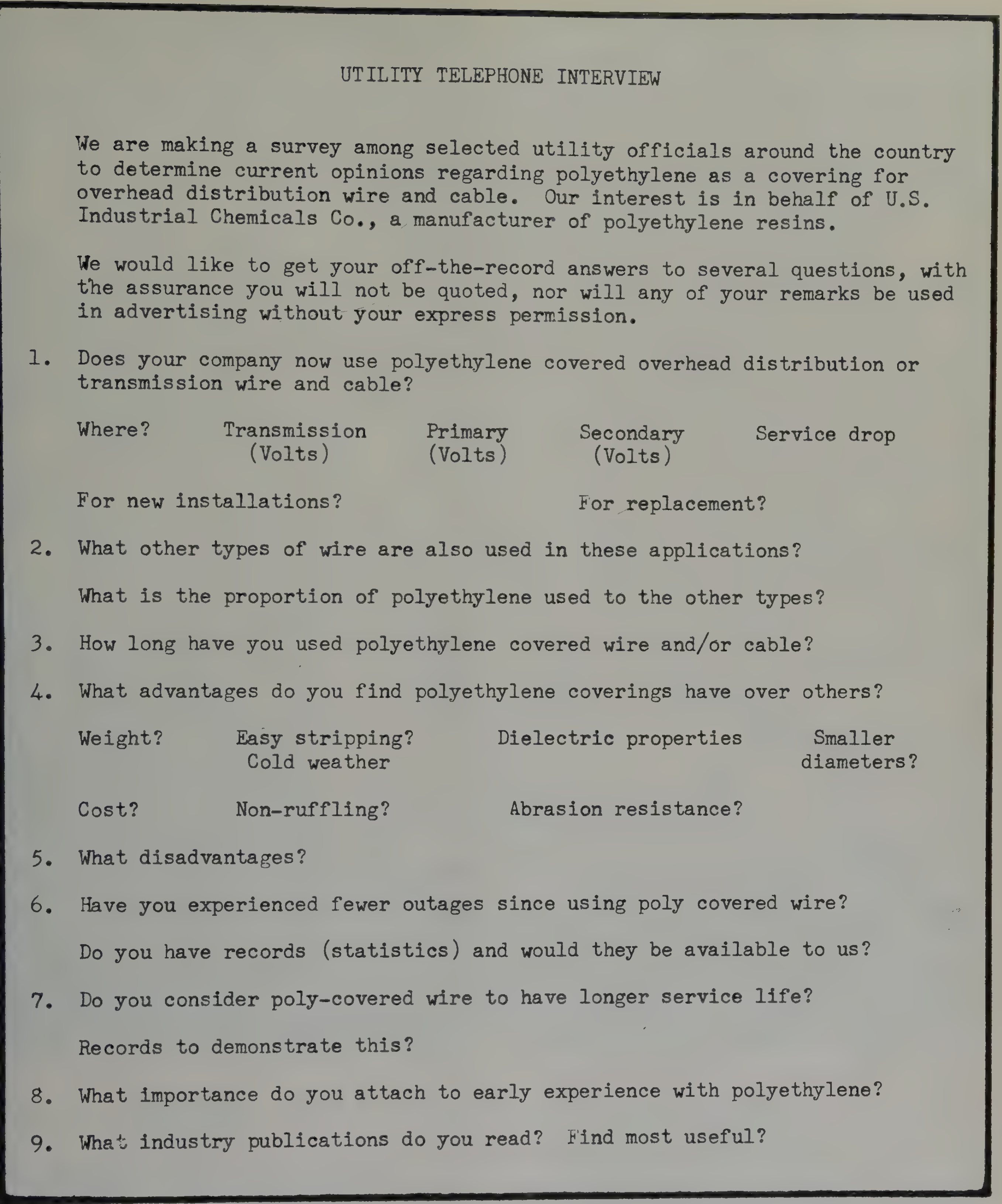
Other advantages cited as a result of possible benefits mentioned on the interview form included favorable dielectric properties, lightweight and small diameters, easy stripping, and good abrasion resistance.

About half of the respondents said that they now use more polyethylene-coated wire than wire coated with competitive materials — neoprene or polyvinyl chloride — or U.R.C. type distribution system wire.

One user of the poly-coated wire, a large Middle Atlantic utility, reported that it uses as many as two dozen different types of such wire for distribution-system service drop. The company also uses poly-coated wire in both primary and secondary installations.

The spot-check revealed that almost every one of the utilities surveyed did not have suitable detailed outage records with which to analyze the performance of distribution system materials. Most of the companies actually did not know for certain whether outages were reduced by use of a given type of wire.

As a result of the interviews, it was apparent that the men charged with the responsibility of operating distribution systems have become much more savvy concerning polyethylene coatings. They now seem to feel that it is important to know the difference between poly coatings — for instance, coatings extruded from high density poly as compared with low and medium density poly coatings. Almost



UTILITY TELEPHONE INTERVIEW

We are making a survey among selected utility officials around the country to determine current opinions regarding polyethylene as a covering for overhead distribution wire and cable. Our interest is in behalf of U.S. Industrial Chemicals Co., a manufacturer of polyethylene resins.

We would like to get your off-the-record answers to several questions, with the assurance you will not be quoted, nor will any of your remarks be used in advertising without your express permission.

1. Does your company now use polyethylene covered overhead distribution or transmission wire and cable?

   Where? Transmission (Volts) Primary (Volts) Secondary (Volts) Service drop

   For new installations? For replacement?

2. What other types of wire are also used in these applications?

   What is the proportion of polyethylene used to the other types?

3. How long have you used polyethylene covered wire and/or cable?

4. What advantages do you find polyethylene coverings have over others?

   Weight? Easy stripping? Cold weather Dielectric properties Smaller diameters?

   Cost? Non-ruffling? Abrasion resistance?

5. What disadvantages?

6. Have you experienced fewer outages since using poly covered wire?

   Do you have records (statistics) and would they be available to us?

7. Do you consider poly-covered wire to have longer service life?

   Records to demonstrate this?

8. What importance do you attach to early experience with polyethylene?

9. What industry publications do you read? Find most useful?

ll the respondents are informed nough to discount the difficulties ncountered many years ago with arly poly-coated wires.

There also seems to be a general ppreciation among distribution system managers that polyethylene's electrical properties vary hardly at all with changing or severe operating conditions.

On the negative side is the finding that nine of those surveyed still question the adequacy of the poly-coated wire's softening point in spite of the fact that conditions which produce temperatures high enough to soften the poly coating are extremes rarely encountered in distribution service.

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Miniaturization is one of the main reasons for many of the technological advances made in the last several decades. As physical size of rotating machinery decreased while temperature ratings increased, development of new insulations for the machines became a necessity.

Selecting Insulation Systems For Rotating Machinery

By Carl Hackney, and Virgil Scardina, Development Laboratory, Norwood (Ohio) Works, Allis-Chalmers Mfg. Co. All illustrations courtesy Allis-Chalmers Mfg. Co.

In this age of technological advances much credit should be given to the art of miniaturization. In the design of rotating machinery, the physical size of this type of machinery has steadily decreased as indicated in figure 1. This decrease in size has been attributed to a combination of factors including a change in manufacturing processes and consumer's demand for more horsepower per cubic foot of space.

As the basic electrical design of dynamo-electric machines has not radically changed during this period, the penalty of this decrease in size and increase in temperature ratings had to be borne by the insulations used in the machines. To meet this demand, manufacturers and suppliers have developed new insulating materials at an ever increasing rate. These new materials will operate at higher temperatures, thus allowing the current carrying conductors to operate at higher current densities. This permits a reduction in the physical size for a given hp or kw output.

Development of these materials at an ever increasing rate means that, whereas before a supplier could recommend one material for a particular application, he can now show you an almost endless variety of materials, all intended for the same use. Previously, the design engineer considered only the applicability of the material from a production standpoint. Now he must include physical properties and chemical compatibility. Consequently, the selection of these materials has become more complex.

Many methods are available for determining the suitability of these materials. Some were designed by the insulation manufacturer and others were developed by the machine builder. In addition, several organizations, such as AIEE and ASTM, are striving constantly to standard-

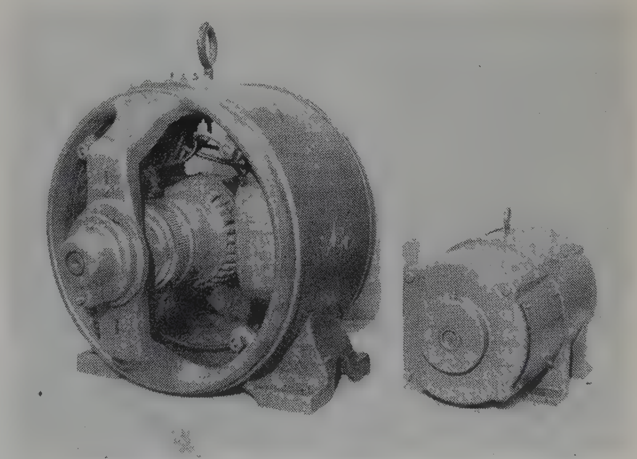
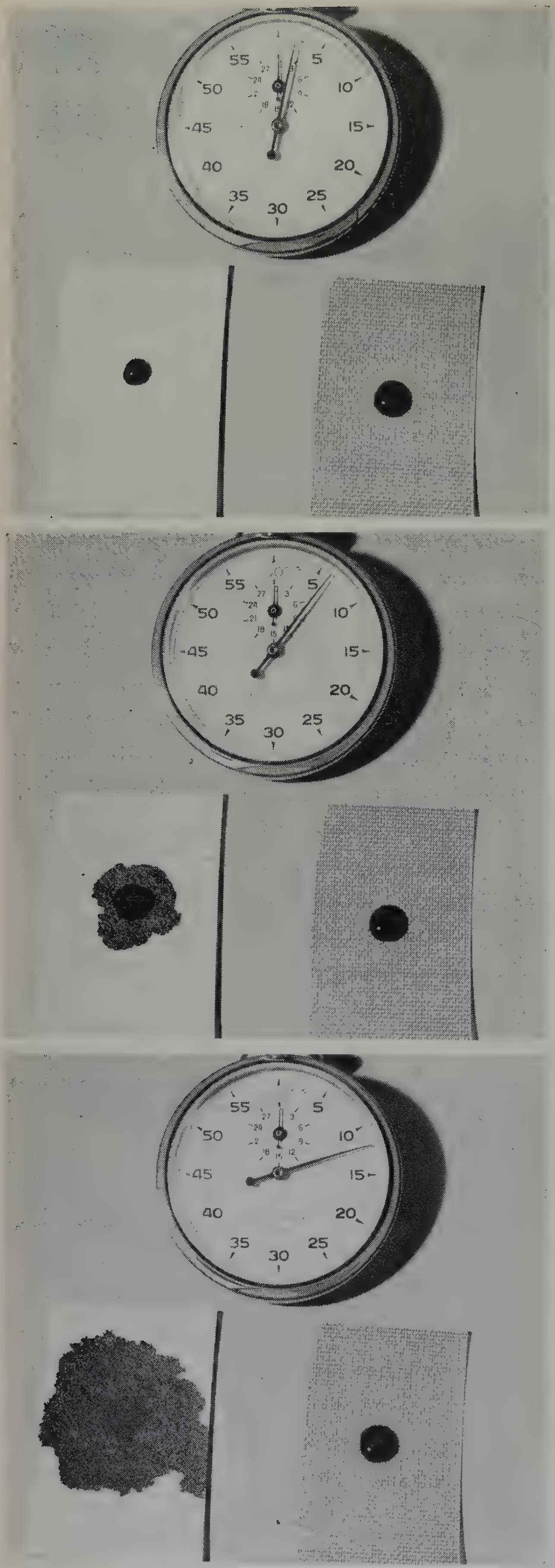


Figure 1, illustration of decreased size of rotating equipment; left, 3 hp, 240-volt, 1050 rpm; right, 3 hp, 240-volt, 1150 rpm.



Figures 2A (top), 2B (middle), and 2C (bottom), varying degrees of absorption shown initially and at 6.2 and 11.8 seconds.

ize and perfect test procedures and methods for determining the life and compatibility of insulating materials and systems.

Nomenclature Defined

A brief description of what is meant by the terms, "system" and "compatibility" might be appropriate at this point.

"System" refers to the combination of insulating materials required to insulate the conductors from each other and from the magnetic core. This would include the type of film used on the conductors; flexible or sheet material for slot cells and phase insulation; laminates or fibres used for wedging; and last, varnishes or resins to protect the inner components from the environment and bond the conductors together.

The term "compatibility" is defined as "getting along well together." It can be classified into three categories: production, physical, and chemical. Production compatibility must be determined first in selecting a material. This consists of determining the following:

1) New material cost versus present material cost.

2) Quality of new material versus old material.

3) Are standard techniques applicable?

4) Can materials be used with existing equipment?

These four factors are actually an initial screening and must be considered from an overall viewpoint. If proven satisfactory, the materials are then subjected to further tests.

Next step in evaluating the material would be to determine physical compatibility. Physical compatibility is a study of the mechanical properties exhibited by the various components of a system. A few examples of physical compatibilities and their correlation to actual applications on rotating machines are:

1) Absorption rate or wetability of various types of sheet insulation. This test would correspond to the dipping of a unit into a varnish or resin and would indicate its degree of impregnation versus dip time. Figures 2a, 2b, and 2c show varying degrees of absorption, initially and at 6.2 and 11.8 seconds.

2) Thermal shock of a resin which determines the ability of that resin to successfully withstand a rupture or parting when it is used to bond various dissimilar materials with different coefficients of expansion.

3) Flexibility test to determine the ability of a material or varnish to withstand continued flexing incurred by such conditions as vibration and movements resulting from the magnetic forces under starting conditions.

Of course, there are many more tests that might be used. The deciding factor in selecting a test is the conditions or application to which the machines will be subjected.

Chemical compatibility, the last category, is a study of the molecular action that may or may not occur between the various components comprising an insulation system and its effects on the system. One method of determining compatibility of wire enamels, varnish, or resins (accepted by both manufacturers and users of magnet wire) is the AIEE test code #57, "Evaluation of the Thermal Stability of Enameled Wire." This is commonly referred to as the twisted pairs test.

Enamel Life Determined Accurately By Twisted Pairs Test

Incompatibility of magnet wire enamel and epoxy resins manifests itself in a deterioration of the enamel which in time results in turn-to-turn failure. Since this is a function of time, the twisted pairs test seeks, by means of accelerated heat aging, to determine the approximate point in the life of an enamel where failure will occur. An average of several such samples has proven to give a statistically accurate indication of enamel life.

To determine compatibility of wire enamel and epoxy resins, two specimens of the wire to be tested are twisted together under tension and potted in a test tube of epoxy resin. After curing, these samples are heat-aged at elevated temperatures. The average life is then calculated from the above test results and plotted on a graph so that a comparison of the various insulations can be made.

A decrease in life of the encapsulated samples, as compared to similar data on the unvarnished twisted pairs, would indicate incompatibility. Figures 3 and 4 show a polyester and a "Formvar" wire enamel potted separately in epoxy resin and tested using AIEE #57 test code as a guide. The expected insulation life is upgraded when using the Formvar wire, whereas the polyester wire is degraded when tested under the same conditions. However, tests in process indicate that with a slight modification (changing accelerator) in the epoxy resin, the trend is reversed where the polyester wire enamel appears to be upgraded and Formvar wire degraded.

One final point—chemical compatibility is an indication of how the insulation will hold up in service while physical compatibility is a method of preselecting materials to obtain the desired properties. Production compatibility would dictate whether new equipment must be purchased and would serve as an initial screening stage.

A system that is physically compatible does not necessarily indicate that it will be chemically compatible. For the end point system, both physical and chemical compatibility results must be evaluated and the best combination is then chosen for the insulation system. The economics of the insulation system must also be considered. In many cases, more costly new materials or combinations of standard materials with new materials will permit production of units at less cost due to changes in production techniques.

The final selection of an insulation system will depend on the construction of the machine—whether it is open, drip-proof, totally enclosed, hermetic sealed, etc.—and on the atmospheric conditions such as high humidity, chemicals, temperature range, etc., under which the units must operate. Development of the many new types of insulation materials has eased the problem of selecting the right one to do the job.

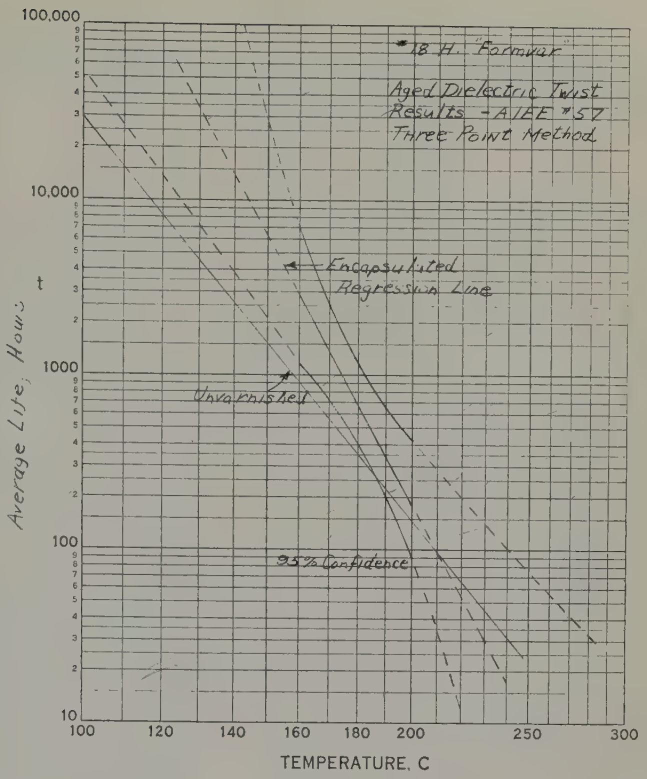


Figure 3, "Formvar" wire enamel potted separately in epoxy resin and tested using AIEE #57 test code as a guide.

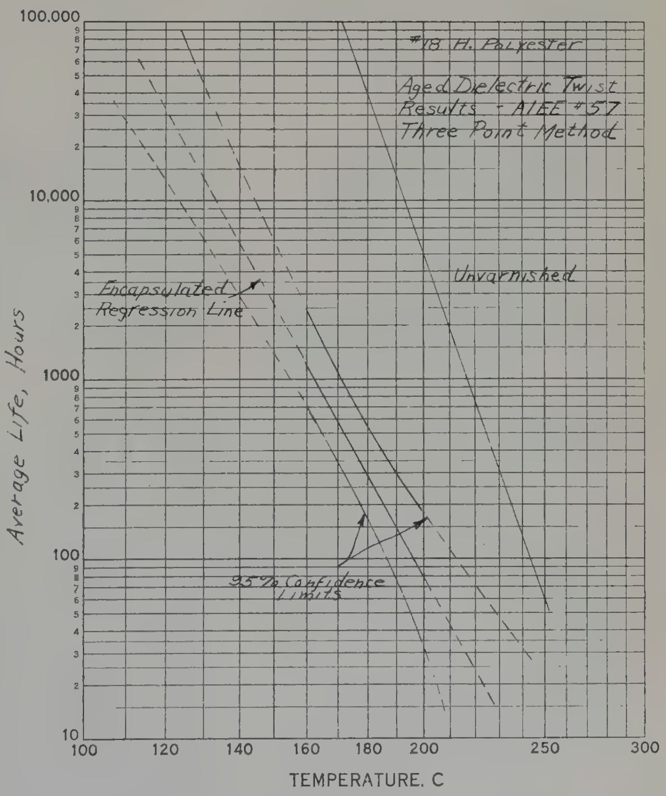


Figure 4, polyester wire enamel potted separately in epoxy resin and tested using AIEE #57 test code as a guide.

Industry News

The U.S. armed forces have given the first military contract for production of electronic equipment in Puerto Rico to the *Electrospace Corp.*, Valley Stream, L.I. Electrospace just opened a new plant in Puerto Rico for the production of telecommunications equipment. Electrospace also has leased a 46,000-sq ft plant at Glen Cove, L.I., to house its executive offices, the production facilities of two of its wholly-owned subsidiaries, *General Hermetic Sealing Corp.* and *Hermetronics Inc.*, and its newly acquired *Coil Cord Division* of *Patton-MacGuyer Inc.*

Radiation Dynamics Inc., Westbury, N.Y., has concluded arrangements with *C. Itoh Corp.*, Tokyo, Japan, to establish an irradiation center there. Existing centers are located in New York City and Paris, France. Also, *Westrex Corp.*, a division of *Litton Industries*, has been named to handle European sales of the Dynamitron, Radiation Dynamics' million volt particle accelerator, and *Vickers Research Ltd.*, Great Britain, has been named to represent it in the British Commonwealth, except Canada.

The name of *Patterson Moos Research Division* of *Leesona Corp.*, Jamaica, L.I., has been changed to *Leesona Moos Laboratories*, a division of *Leesona Corp.*

Fryco, Scottsdale, Ariz., has been named to handle Arizona and New Mexico sales of beryllium oxide ceramic insulation products made by *National Beryllia Corp.*, Haskell, N.J.

Instrument Systems Corp., College Point, N.Y., has been appointed a distributor of Siemens Hall-Effect devices made by *Siemens-Halske A.G.* of Germany.

The *Westinghouse Electric Corp.*, East Pittsburgh, Pa., has organized a new industry systems department with responsibility for the development, design, and sale of complex systems for control of processes in industry.

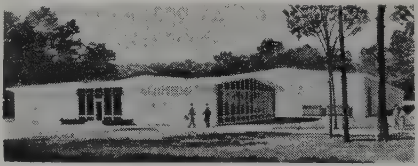
Tri-State Supply Corp., with warehouses in Los Angeles, San Francisco, and Seattle, has been added to West Coast distributors of fiberglass electrical insulating tapes made by the *Horace Linton Div., Hess, Goldsmith & Co.*, Philadelphia, Pa.

Radiation Dynamics Inc., Westbury, N.Y., manufacturer of Dynamitron multi-million volt particle accelerators, has acquired controlling interest in *Advanced Research Corp.*, West Lafayette, Ind.

Plastics Corporation of America Inc., Minneapolis, has acquired *United Fabricators & Electronics Inc.*, a nine-year-old manufacturer of precision plastic products headquartered in Stillwater, Minn.

The *Brand-Rex Div., American Enka Corp.*, has discontinued its cable assembly business in Santa Monica, Calif., sold its cable molding equipment to *Cadre Industries*, Endicott, N.Y., and moved all manufacturing facilities to a new, integrated wire and cable manufacturing facility in Gardena, Calif.

International Instruments Inc., manufacturer of miniature electrical and electronic components, has moved into a new all-metal, windowless plant in Orange, Conn., which has its own self-contained and controlled atmosphere.



Robertshaw-Fulton Controls Co., Richmond, Va., has acquired *Lux Clock Manufacturing Co. Inc.*, Waterbury, Conn., which now operates as *Lux Time Div.* of R-F.

General Cable Corp., New York City, has appointed *Atlas Wire & Cable Co. Inc.*, also of that city, to market its products through industrial electronics distributors.

Wadsworth-Pacific Mfg. Associates Inc., with offices in San Francisco and Los Angeles, has been named to represent *Diamonite Products Mfg. Co.*, Shreve, Ohio, manufacturer of high alumina ceramic components.

Sylvania Electric Products Inc., subsidiary of *General Telephone & Electronics Corp.*, plans to increase its Semiconductor Division manufacturing facilities in Woburn, Mass., and Hillsboro, N.H., by a total of more than 40%. At the same time, Sylvania announced that it will discontinue operations at its receiving tube plant in Shawnee, Okla.

Bishop Manufacturing Corp., Cedar Grove, N.J., manufacturer of insulating tapes, compounds, and special formulations, has appointed *Harlan J. Weisler Associates* to represent it in eastern Missouri.

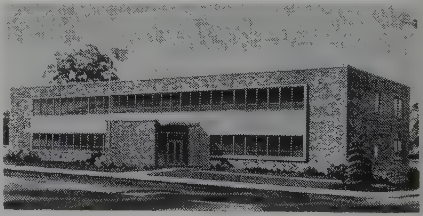
Thompson Engineering Services, St. Louis, has been appointed midwestern sales representative by *A-T Electronics Inc.*, New Haven, Conn., fabricator and distributor of coaxial cable and manufacturer of feed networks and delay lines.

Hillburn Electronics Corp., a wholly owned relay manufacturing subsidiary of *Loral Electronics Corp.*, New York City, has moved to a 15,000 sq ft plant in Brooklyn.

Oak Manufacturing Co., electrical and electronic components manufacturer, has opened a new 206,000 sq ft general office and manufacturing plant in Crystal Lake, Ill. This provides Oak with a total of 320,000 sq ft of space in two plants on a 32-acre site there.

Consolidated Electrodynamics Corp., Pasadena, Calif., subsidiary of *Bell & Howell Co.*, has integrated its *Datalab Div.* into the *Data Recorders Div.* and *Consolidated Systems Corp.*

Shawinigan Resins Corp. plans to construct a $500,000 office building at its headquarters in Springfield, Mass.



SILICOLOGY *Studies in Silicones*

HOW THESE TIME-TESTED MATERIALS CAN WORK FOR YOU

Silicone Rubber Takes to the Air ...And a Customer Tells Us Why

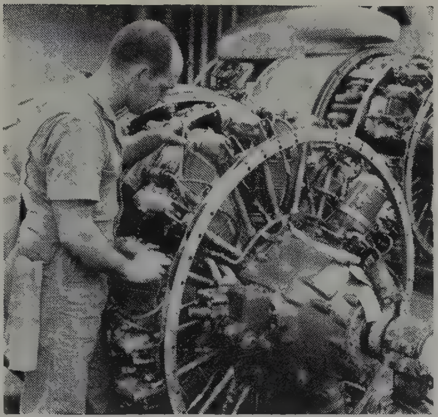
A recent letter from a Union Carbide Silicone Rubber customer is one of those that makes us like to read our mail. We quote parts of it below in the hope that it will serve as a "refresher" on the properties that have made silicone rubber virtually indispensable in modern aircraft.

The letter is from the Engineering Laboratories of the Electric Autolite Company, Wire and Cable Division, Port Huron, Mich., which states:

RESISTS OZONE, CORONA, COLD, AND MOISTURE

"Silicone rubber, because of its excellent heat resistance and dielectric strength, has been specified as insulation on aircraft lead wire for a number of years. More recently, these same properties have promoted its use on ignition cables for automobiles, aircraft, and military vehicles. Spark plug boots, attached to the cables, are also molded of silicone rubber because of the continuous high temperatures to which they are subjected.

"In addition to dielectric and heat-resisting properties, there are other advantages in the use of silicone extruded insulation. It is readily compounded for extrusion, extrudes smoothly, and strips easily from the conductor; the finished wire has excellent shelf life as well as good service life, it can be used at high altitude, remains flexible at low temperatures, and resists ozone, corona, and moisture."

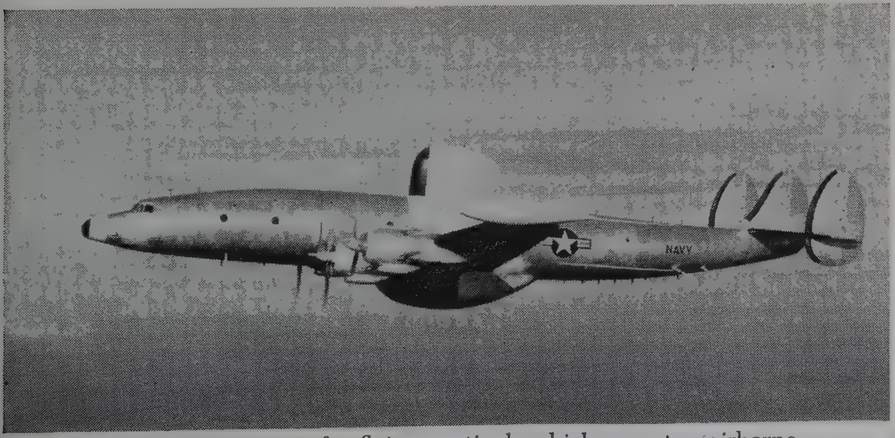


SILICONE rubber-insulated wire and cable, capable of withstanding continuous high temperatures, is used in powerful aircraft engines.

MORE RELIABLE FOR CARS, TOO

The letter gives a forward-looking hint to Detroit as it goes on to state: "Newer automobile engine designs, for greater efficiency by operation at higher temperatures, should further increase the requirements for this more reliable ignition cable.

"Union Carbide Silicone Rubbers are among those used for The Electric Autolite Company's insulated wires and cables, and their KW-1330 silicone rubber base has been approved for use on ignition cables."



U. S. NAVY'S WV-2 far-flying sentinel, which can stay airborne for extended periods of time, carries America's most powerful search radar as part of the nation's defense against sneak attacks.

Bendix Corporation, Scintilla Division, is one of Autolite's customers. Bendix in turn supplied the silicone-insulated spark plug leads for engines that power such giants of the skies as the Lockheed Super Constellation-type radar airplanes, designated by the United States Navy as WV-2. Able to range far out to sea and carry out special early warning missions, this long-distance plane carries America's most powerful search radar to high altitudes to avoid normal limitations from radar's inability to bend over the horizon.

WHERE CAN SILICONES BENEFIT YOU?

You'll also find silicone-insulated ignition cables boosting the reliability of military vehicles, tanks, and trucks. And if you're a track fan, they're virtually a "must" to stock car racers.

Aircraft technology and development are changing more rapidly than ever before. Perhaps you are overlooking a good bet—some place in the design of your products where a Union Carbide Silicone Rubber can serve you, improving quality at a surprisingly low cost. Send the coupon for further information.

UNION CARBIDE

SILICONES

Union Carbide is a registered trade mark of Union Carbide Corporation.

Silicones Division
Union Carbide Corporation
Dept. IJ-9105, 30-20 Thomson Avenue,
Long Island City 1, N. Y.
In Canada: Union Carbide Canada, Ltd.,
Bakelite Division, Toronto 12.

Please send me data on ____________

____

Name ____________

Title ____________

Company ____________

Address ____________

City ____________ Zone ____ State ____

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People in the News

Personnel changes announced by Union Carbide Plastics Co., Division of Union Carbide Corp., New York City, include the following: *W. Kenneth Hill,* assigned to the New England Sales Region, Needham Heights, Mass.; *Dr. Gilbert I. Addis,* appointed assistant director of vinyl planning, Bound Brook, N.J.; *Richard L. Garrison,* appointed assistant regional manager in the North Central Sales Region, Detroit, Mich.; and *Harry J. McGowan,* assigned as special sales representative in the North Central Sales Region, same location.

George J. Muller has been named manager of its recently-expanded Special Projects Group by Taylor Fibre Co., Norristown, Pa. *William J. Koness* has been moved from Indianapolis to Rochester, Mich., where he now heads Taylor's Detroit sales district.

W. Koness

G. Muller

A. W. Warren has been named manager of manufacturing administration for the Service Shops Dept., General Electric Co., Schenectady, N.Y. In the Silicone Products Dept., Waterford, N.Y., *William C. Giegold* has been named manager of quality control, and *Frank V. Summers* has been promoted to manager of intermediates process engineering.

W. C. Giegold

F. V. Summers

John R. Goggin has been named manager of maintenance and utilities at G-E's Silicone Products Dept., Waterford, N.Y. In Coshocton, Ohio, *Douglas J. Clark* has been appointed "Textolite" industrial sales representative for the G-E Laminated Products Department.

At Mystik Adhesive Products, Inc., Chicago, *C. P. Scott* has been appointed technical service manager, *Frances E. Weeg* has been promoted to manager of manufacturing, and *Frederick C. Beyer* named manager of quality control.

Sidney H. Linwood has been promoted to chief engineer of the Ferrite Engineering Dept., Stackpole Carbon Co., St. Marys, Pa., and *Dudley H. Campbell* has been named to the newly created post of chief engineer of the Control and Switch Dept.

Charles R. Stelljes has been named manager of engineering and research for the Portable Tool Div., The Porter-Cable Machine Co., Syracuse, N.Y., a subsidiary of the Rockwell Manufacturing Co.

C. Stelljes

R. Sweet

Robert S. Sweet has joined the New England sales staff of Schenectady Varnish Co. Inc., Schenectady, N.Y.

Devereaux Martin has joined Estey Electronics Inc., Torrance, Calif., as general operations manager.

The U.S. Stoneware Co., Akron, Ohio, has appointed *Paul L. Schmitz* as sales manager of The Alite Division and named *Walter J. Tarnacki* manager of Alite high alumina ceramic manufacturing operations.

L. F. Hickernell, vice president—engineering of the Anaconda Wire and Cable Co., Hastings-on-Hudson, N.Y., has received an honorary degree of Doctor of Engineering from Polytechnic Institute of Brooklyn.

Benjamin F. Cheydleur has been appointed to the engineering staff of the Computer Div., Philco Corp., Willow Grove, Pa.

New appointments in the Allis-Chalmers Manufacturing Co. regulator department include that of *R. E. Horn* as manager, and *A. H. Baguhn,* chief engineer. Newly named to the A-C Industries Group are *Richmond P. Johnston,* application engineer, power systems engineering; *James Massara,* application engineer, regulator department, and *Morris G. Meier,* application engineer, processing machinery department. The Norwood Works has appointed *Ted Merkel* as application engineer in the pump department, and named *Louis E. Welch* as assistant engineer in the d-c machine design section of the electrical department.

Edgar G. Grant has been named director of new product planning for the Military Electronics Div., Daystrom Inc., Archbald, Pa. *Pat Minervini* has been named engineering manager to succeed Grant, and *Bernard Plevyak* has been promoted to chief product engineer to replace Minervini.

P. Minervini

B. Plevyak

E. G. Grant

A. Bluestein

Allen C. Bluestein has been appointed director of research for the New Bedford (Mass.) Division of the Aerovox Corp.

Shipley Co. Inc., Wellesley, Mass.,

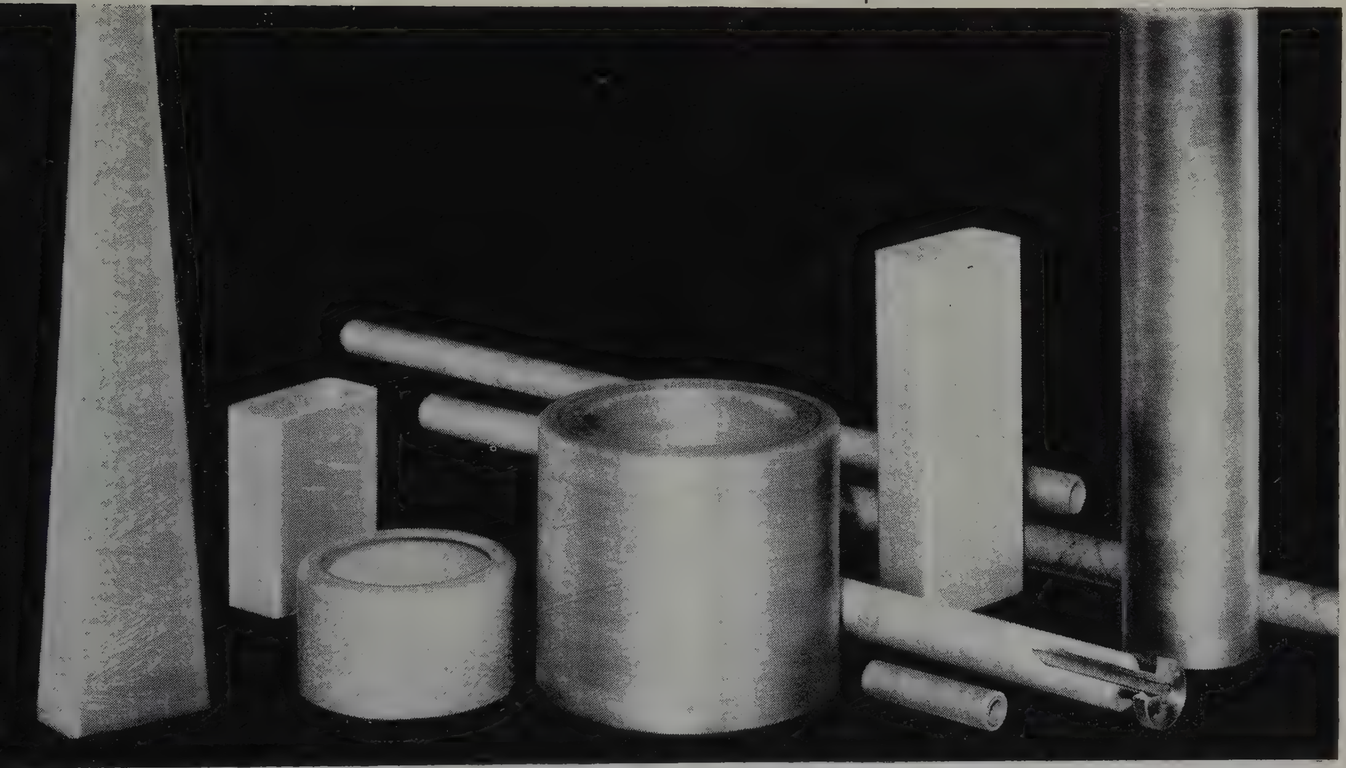
SPAULDING GFW-60*

*Glass filament wound epoxy tubing gives industry a new high burst strength material

Spaulding GFW-60 is designed to provide industry with a material of extremely high burst strengths for such applications as circuit breaker arc interruption chambers, high-voltage fuse tubes, switch gear and similar type components. It can be furnished with fibre liners, metal inserts, or with conductive layers.

Its ratio of burst strength to axial tensile strength can be varied to fit specific applications.

It is available in a variety of circular sizes and lengths, and with special shapes.



PROFILE OF CHARACTERISTICS

SPAULDING GFW-60 (1" x 1¼" size)		
Water Absorption	%	.05
Grease Burst	psi	22,500
Tensile Strength	psi	8,250
Compression Strength Axially Radially	psi As Received As Received	 19,300 920
Dielectric Strength V/M Perpendicular	Short Time	401+

As with All of its Products for Industry, Spaulding Offers Complete Value Analysis and Fabricating Services for Your Application of GFW-60. Contact Spaulding for Details.

SPAULDING FIBRE COMPANY, INC.
345 WHEELER STREET, TONAWANDA, NEW YORK

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has promoted *James L. Baudreau* to manage its West Coast sales from the new headquarters in Los Angeles.

Chester L. Jones has been promoted to director of marketing for the Plastics Div., Monsanto Chemical Co., to succeed *R. Carl Evans,* who has been named associate director of the Purchasing and Traffic Dept., St. Louis.

Robert W. Lear has joined The Carborundum Co., Niagara Falls, N.Y., as vice president in charge of marketing.

Dr. Nathan Marcuvitz has been named acting dean of the Long Island Graduate Center, Polytechnic Institute of Brooklyn, Farmingdale. He retains his post of vice president for research at Polytechnic.

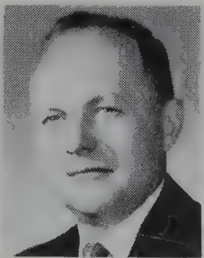
The Zippertubing Co., Los Angeles, has appointed *Jay Cooley* as eastern regional sales manager, South Hackensack, N.J.; *Jack Mills,* central regional sales manager; *Chuck Pearson,* western regional sales manager. Mills and Pearson will work out of the company's Los Angeles headquarters.

Louis Kahn has been appointed vice president in charge of engineering for the Astron Corp., East Newark, N.J.

At The Richardson Co., Melrose Park, Ill., *Dr. Stephen J. Groszos* has been named technical director, and *Ramon A. Mulholland* has been appointed director of commercial development.

At the Rea Magnet Wire Co. Inc., division of Aluminum Co. of America, Ft. Wayne, Ind., *Irving O. Schaefer* has been promoted to assistant technical director for electrical research and development, and *Frank R. Roubik* has been named chief product engineer.

I. Schaefer



F. Roubik

J. R. Garey has been appointed general manager of its new wire and cable plant in Gardena, Calif., by the Brand-Rex Div., American Enka Corp.

J. R. Garey

A. C. Packard

Babcock Electronics Corp., Costa Mesa, Calif., has appointed *A. C. Packard,* formerly deputy director of the Federal Aviation Agency Bureau of Research and Development, as manager of weapons systems.

Dr. W. Donald Thompson has been appointed manager of research and development for the Fiber Development Dept., Hercules Powder Co., Covington, Va. *Dr. Richard Stanley George* has been named director of sales, organic chemicals, by the Synthetics Dept.

Vernon A. Kamin has been appointed marketing manager, Ceramic Products, and *Bruce Vinkemulder* has been named marketing manager, Electro-Mechanical Products, both new marketing groups at Centralab, Electronics Div. of Globe-Union Inc., Milwaukee.

Gilbert R. Shockley has been named general director, product development division, by Reynolds Metals Co., Richmond, Va.

Wesley Copley has been transferred by Emerson & Cuming Inc., Canton, Mass., from the New England sales area to the New York office where he will be responsible for sales in northern New Jersey.

John L. Hague has been appointed chief of the Standard Reference Materials Section, National Bureau of Standards, Washington, D.C. At the NBS Boulder (Colo.) Laboratories, *Martin T. Decker* has been appointed Chief of the Tropospheric Measurements Section.

Walter F. Harney has been appointed sales engineer for the Pacific Div., Tensolite Insulated Wire Co., Los Angeles, Calif.

New chief engineer of Estey Electronics Inc., Torrance, Calif., is *John R. Bartholomew. Fred G. Krueger* has been named consultant electronic engineer.

Professor *Frank E. Canavaciol,* well-known engineering educator whose research work in the early thirties led to the development of the first ceramic insulator created for radio, recently retired from Polytechnic Institute of Brooklyn.

Daniel B. Granzow has joined Phillips Control Co., Joliet, Ill., as manager of development engineering.

Carlyle A. Mounteer has joined Consolidated Electrodynamics Corp., subsidiary of Bell & Howell Co., as assistant general manager of the Transducer Div., Monrovia, Calif. At Pasadena, Calif., *Alan G. Richards* has joined the B&H Research Center as assistant to the director.

New promotions at Chemo Products Inc., West Warwick, R.I., include that of *Herb Whitaker* to sales manager and *Hugo Di Clemente* to assistant sales manager.

H. Whitaker

H. Di Clemente

James W. L. Monkman has been named to the newly created post of director of sales for plastics in the Polymers Dept., Hercules Powder Co., Wilmington, Del.

Philip A. Christophe has joined Emmco Plastics Corp., Everett, Mass., as assistant treasurer.

Thomas H. Kiernan has been assigned to the Chicago territory as sales representative for fiber glass insulating products by Johns-Manville Sales Corp.

Dr. Andrew Herczog has been appointed a senior research associate in electronics at Corning Glass Works, Corning, N.Y.

Rogers Corp., Rogers, Conn., has named *William F. Ames* as sales engineer in Chicago. His territory includes northern Illinois, western Michigan, and eastern Indiana.

Stancor Electronics Inc., formerly

Chicago Standard Transformer Corp., has added three engineers to its staff: *Joseph S. Ramer* has been appointed director of engineering in Chicago; *C. Edwin Williams* will be technical consultant at the Easton, Pa. plant; and *John de Leon* has been named engineer at Easton.

J. Ramer

J. de Leon

New officers recently elected by Saxonburg Ceramics Inc., Saxonburg, Pa., are *Florence B. Aderhold,* president and treasurer; *John G. Pabst,* vice president of sales and secretary; *William C. Stetson,* vice president of manufacturing; and *Robert J. Snyder,* assistant secretary and assistant treasurer.

Percy F. Leaper has been named midwestern sales representative for Tri-Point Industries Inc., Albertson, N.Y.

Norman Hirschfield has been elected chairman of the board and chief executive officer of The Teleregister Corp., New York City, to succeed the retired *Capt. William Nelson.*

N. Hirschfield

J. MacLeod

John C. MacLeod has been appointed to the newly created position of vice president for operations of Barrett Div., Allied Chemical Corp., New York City.

Mrs. Clytia C. Montllor has been appointed staff assistant to the president, Radiation Applications Inc., Long Island, N.Y.

David Shore has been appointed head of the SAINT Program Group, Radio Corp. of America, Burlington,

THESE ARE SPRAGUE'S TWO OUTSTANDING

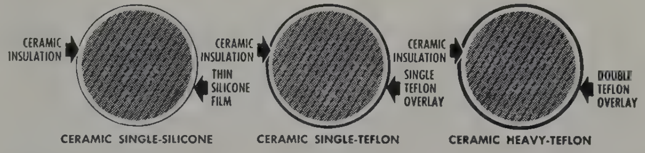
HIGH-TEMPERATURE MAGNET WIRES

Tetroc®

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO 200°C

Ceroc®

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO 250°C



ENLARGED CROSS-SECTIONS OF CEROC® COPPER MAGNET WIRE

Sprague offers you a choice of 2 *truly* high temperature magnet wires: For continuous operation at hottest spot temperatures up to 200°C (392°F) and up to 250°C (482°F) for short periods of time — depend upon TETROC — an all Teflon-insulated wire available in both single and heavy coatings.

CEROC is Sprague's recommendation for continuous operation at hottest spot temperatures up to 250°C (482°F) and up to 300°C (572°F) for short periods of time. Ceroc has a flexible ceramic base insulation with either single silicone or single or heavy Teflon overlays. The ceramic base stops "cut-through" sometimes found in windings of all-fluorocarbon wire. Both Tetroc and Ceroc magnet wires provide extremely high space factors. ★ ★ ★ ★ ★

FOR COMPLETE DATA WRITE FOR ENGINEERING BULLETIN 405 (TETROC WIRES) 400A (CEROC WIRES).

SPRAGUE ELECTRIC COMPANY
441 MARSHALL STREET, NORTH ADAMS, MASS.

SPRAGUE®
THE MARK OF RELIABILITY

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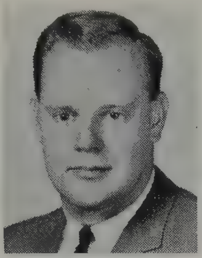
Mass.

J. P. Stevens & Co. Inc., New York City, has appointed *J. S. McBride* as eastern sales representative for its Industrial Glass Fabrics Dept.

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has appointed *Dr. Charles W. Walton* vice president of research to succeed *Dr. Carl Barnes* who recently resigned.

John Kilgallon has been appointed Canadian field sales engineer for wire and cable and plastic extruding machinery produced by Davis-Standard, division of Franklin Research and Development Corp., Mystic, Conn.

J. Kilgallon


T. Davis

Thomas R. Davis has joined Conap Inc., New York City, as technical sales engineer on the East Coast for epoxy and urethane compounds.

Sylvania Electric Products Inc., General Telephone & Electronics Corp., has appointed *William D. Hogan* to the newly created position of manager of engineering services for its Semiconductor Div., Woburn, Mass. *Patrick W. Kelly* has been named product planning manager for its Buffalo (N.Y.) Operations.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has appointed *Dane T. Scag* assistant director of research in its Research Div., and named *Leonard J. Linde* director of engineering, Industries Group.

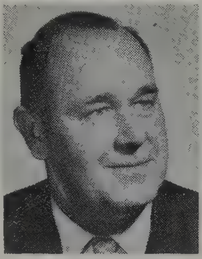
Robert L. Anderson has been named a project manager at Designers for Industry Inc., Cleveland.

New appointments in plastics sales at the Polymers Dept., Hercules Powder Co., Wilmington, Del., include the following: *Emmett E. Hixon*, manager of plastics sales; *Robert C. Clark*, product manager of high-density polyethylene; *Robert D. Ullrich*, product manager of polypropylene; *George M. Taylor*, product supervisor of chlorinated polyether; *William O. Bracken*, supervisor of market development; and *Russell D. Hanna*, supervisor of technical service. All will be located in the company's Wilmington, Del., home office except Hanna, whose headquarters are at the Parlin (N.J.) Plastics Sales Service Laboratory.

Harry L. Saums, consulting engineer for magnet wire at the Anaconda Wire and Cable Company's Magnet Wire Research and Development Laboratory, has received an honorary electrical engineering degree from South Dakota State College.

Lannon F. Mead, president and chief executive officer of The Regina Corp., Rahway, N.J., has been elected to the board of directors and to the executive committee of General Railway Signal Co., Rochester, N.Y.

Edward E. Tschantz has been appointed to the newly created position of chief engineer, Fastener Div., United Shoe Machinery Corp., Shelton, Conn.


E. Tschantz

W. Yeager

William A. Yeager has been appointed sales representative throughout Wisconsin and Minnesota, with headquarters in Milwaukee, for the Micarta Div., Westinghouse Electric Corp.

At Trinity Equipment Corp., Cortland, N.Y., *Marcel Verrando* has been promoted to chief engineer.

R. B. Nottingham has joined The Hoover Co., Electronics Div., Timonium, Md., as director of engineering.

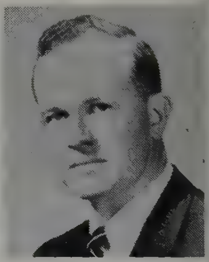
R. Nottingham

R. Walker

A new materials engineer at Moxness Products Inc., Racine, Wis., a subsidiary of Plastics Corp. of America Inc., is *Robert D. Walker*.

Alex W. Warner has joined Dytronics Inc., Rochester, Mich., die-stamped circuit manufacturing subsidiary of Taylor Fibre Co., as vice president and general manager to replace *Harry L. Hildebrand*, who has resigned. At Norristown, Pa., five appointments have been announced by Taylor. *Richard R. Hydeman* has been promoted to vice president of marketing and engineering. *Frank P. Kelly* has joined the company as vice president of manufacturing. *Dr. Fred P. Baughman* has been moved up to technical coordinator to succeed *Dr. Carlisle M. Thacker* who has resigned. In the Sales Dept., *Richard L. Smith* has been appointed to the newly-created position of product sales manager. *Gerald R. Pokrant*, formerly a sales engineer in the Cleveland sales district, has been named to succeed Smith as manager of the Rochester, N.Y., sales office.

F. Kelly

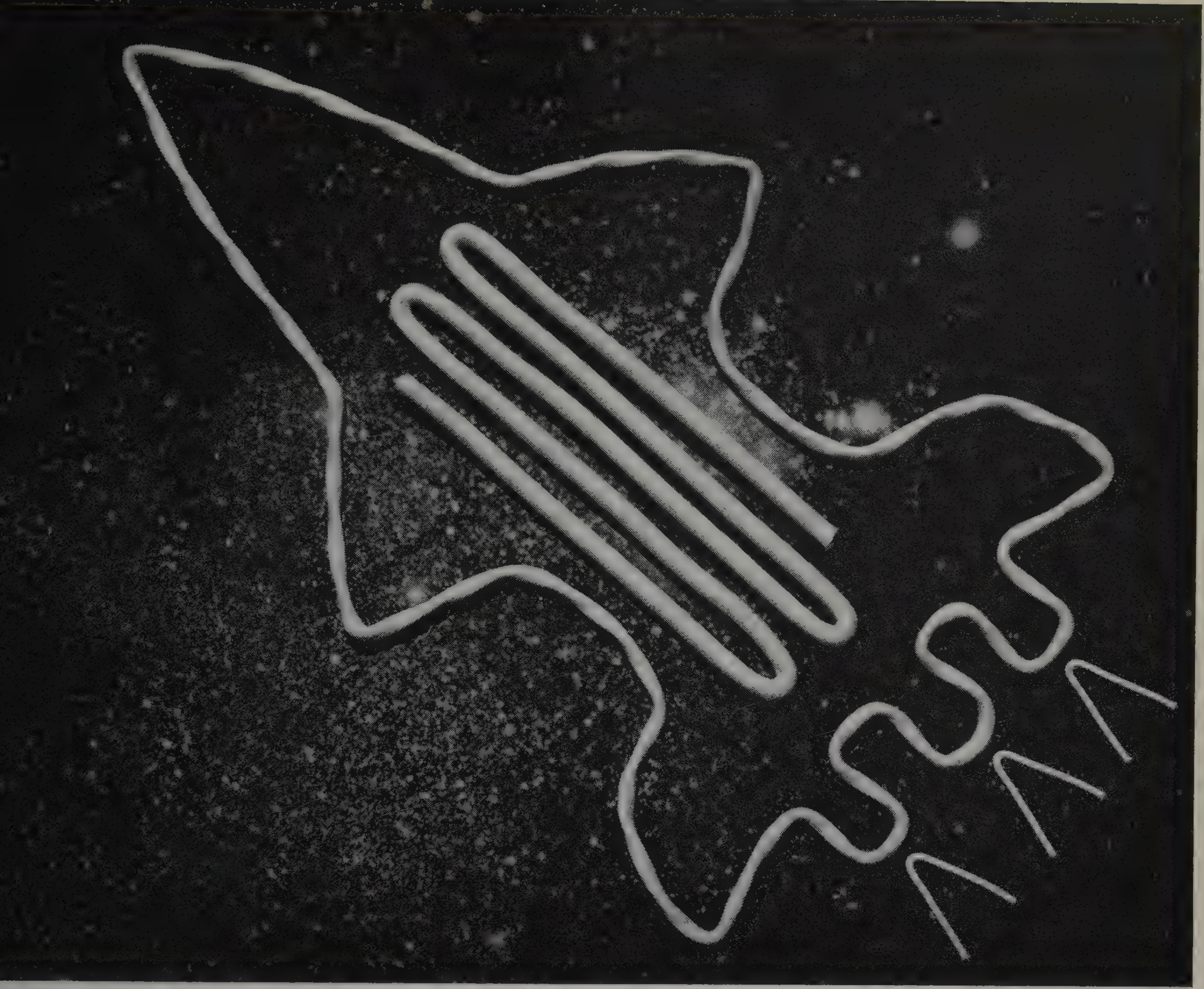

R. Hydeman

A. Warner

F. Baughman

Insulation Manufacturers Corp. has promoted *Paul K. Wolfram* from Cleveland to Chicago as sales manager. *Bob Beetz* has joined IMC in Cleveland, and *E. E. Lackey* has been named branch manager in the new Buffalo (N.Y.) office.

Siegler Corp., New York City, has promoted *Dr. Henry S. Katzenstein* to the new position of director of engineering for government and industrial operations, Olympic Radio and Television Div.



Protect space-traveling cables against heat, moisture and abrasion with J-M Teflon*-Coated Fiber Glass Yarn

eflon-coated J-M Fiber Glass Yarn as especially developed to protect e various types of electrical wires, bles, sleeving and lacing cord used aircraft, rockets and missiles.

In critical service conditions, its otective performance is outstand- g. Here are its most important ad- ntages:

- Maximum abrasion resistance
- Greater flex life . . . because each strand is coated and separate from adjacent strands
- Unusually high moisture resistance
- Performs at temperatures ranging from 500 F. to minus 100 F.
- High resistance to dielectric breakdown
- Highly resistant to effects of weathering
- Chemically, virtually inert
- Low surface coefficient of friction

After braiding onto wire or cable, the covering is sintered by the manufacturer at about 650 F., causing a slight flow of the Teflon—just enough to bond it with adjacent strands for an unbroken Teflon coating.

J-M Fiber Glass Yarn is coated with 12% or 15% Teflon, or to meet your specifications. It is available in these sizes: 450-1/2 . . . 225-1/2 . . . 150-1/2 . . . 150-1/3 . . . and 150-2/2. The yarn is supplied in plied constructions on multiple-end wound braider and serving packages for use with standard braiding equipment.

For more details, call your Johns-Manville Representative. Or write J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ont.

**Registered trademark of the Du Pont Company for tetrafluoroethylene resin.*

JOHNS-MANVILLE
FIBER GLASS
JOHNS MANVILLE JM PRODUCTS

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New Publications

American Electricians' Handbook, by Clifford C. Carr. Revised compilation of information on electrical equipment and materials is presented without the use of advanced mathematics and arranged to be as useful as possible for the selection, installation, maintenance, and operation of electrical equipment. 1676 pages, 1620 illustrations, 6" x 9", $17.50. McGraw-Hill Book Co., 330 West 42nd St., New York 36.

Who's Who in the Electronics Industry. Biographies of engineers, scientists, executives, and educators engaged in all phases of the electronic industry are indexed alphabetically and geographically and include detailed information on personal, academic, and professional achievements. 8½" x 11", $49.50. SETI Publishers Ltd., 176 East 75th St., New York 21.

Design Parameters for Data Processing and Communications Equipment. Consists of the Proceedings of the 1960 annual meeting of the Institute of Printed Circuits. $5. Order from the IPC, 27 East Monroe St., Chicago 3.

ASTM Standards on Copper and Copper Alloys-B-5. This compilation contains 134 standards of which 37 are new, revised, or have had their status changed since the previous edition in 1959. Hard cover, 760 pages, $9.25 ($7.40 to members). American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

C37.6-1961, *American Standard Schedules of Preferred Ratings for Power Circuit Breakers.* Sixth revision of this standard. 80 cents. American Standards Association, Dept. P 237, 10 East 40th St., New York 16.

New EIA Standards

The following new technical standards may be ordered from the Electronic Industries Association, Engineering Dept., 11 West 42nd St., New York 36.

RS-167-A, *Type Designations for Receiver-Type Tube Sockets.* 90 cents.

RS-186-B, *Standard Test Methods for Electronic Component Parts.* $1.90.

RS-240, *Electrical Performance Standards for Television Broadcast Transmitters Channels 2-6 (54mc-88mc), 7-13 (174mc-216mc), 14-83 (740mc-890mc).* $1.80.

OTS Reports

The following reports may be obtained from the Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D.C.

PB 171 563, *Stereospecificity and Dielectric Properties of Polar Polymers,* by H. H. Zabusky and H. A. Pohl. Describes a simple method of predicting the average moments of vinyl polymers by using molecular models and considering successive monomer units pair by pair as they lie in space. 52 pages, $1.50.

Patent Abstract Series. Seven volume Supplement No. 3 (July 1958 through December 1960) describes thousands of Government-owned patents nearly all of which are now available for license at no charge by private firms and individuals for non-exclusive use. It consists of the following seven booklets:

PB 171 672, *Instrumentation,* $1.

PB 171, 673, *Chemical Products and Processes,* $1.50.

PB 171 674, *Food Products and Processes,* 50 cents.

PB 171 675, *Metal Processes and Apparatus, Machinery, and Transportation Equipment,* $1.25.

PB 171 676, *Electrical and Electronic Apparatus,* $1.75.

PB 171 677, *Ordnance,* 50 cents.

PB 171 678, *Ceramic, Paper, Rubber, Textile, Wood and Other Products and Processes,* 50 cents.

ASESA Bulletins

The following listed bulletins describe action taken by the Armed Services Electro-Standards Agency, Fort Monmouth, N. J. Date of the latest change, addition, or deletion is given. Printed copies of the bulletins are not yet available.

Mil-R-10509D, *Resistors, Fixed Film (High Stability).* Revision D and several detail specifications dated 17 January 1961 supersede Mil-R-10509C dated 29 September 1958.

Mil-P-27538, *Plastic Sheet, FEP-Fluorocarbon (Unfilled), Copper Clad (For Printed Wiring).* Dated 17 February 1961.

Mil-C-26655A, *Capacitors, Fixed, Solid Electrolyte, Tantalum.* Amendment 1, Mil-C-26655/1B, and Mil-C-26655/2A dated March 1961.

Mil-D-3954A, *Dummy Loads, Electrical Waveguide.* Amendment 2 and Revision A dated 5 April 1961.

Mil-C-3989A, *Connectors, Coaxial, Radio Frequency, Series C, and Associated Fittings, General Specification for.* Revision A and Supplement 1 dated 1 May 1961.

Mil-W-3970, *Waveguide Assemblies, Rigid.* Revision B to MS35156 through MS35167 dated 5 April 1961.

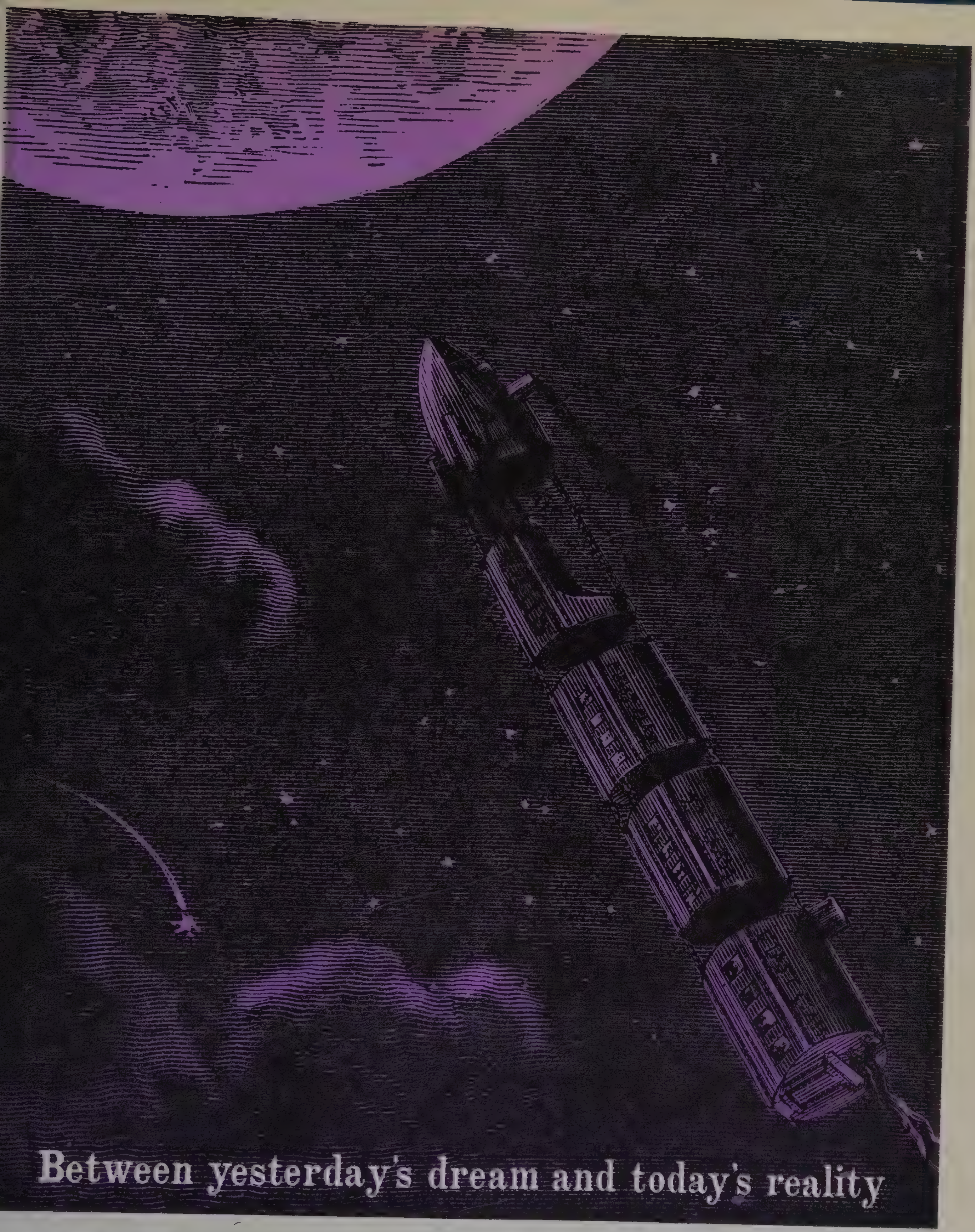
Mil-C-3098C, *Crystal Units, Quartz.* Dated 10 May 1961. With detail specifications it supersedes Mil-C-3098B, Mil-C-7241(USAF), Mil-C-19374 (USAF), Mil-C-25538(USAF), Mil-C-25498(USAF), Mil-C-25709(USAF), Mil-C-25710(USAF), Mil-C-25711(USAF), Mil-C-25712(USAF), Mil-C-25953(USAF), and Mil-C-21240(SHIPS).

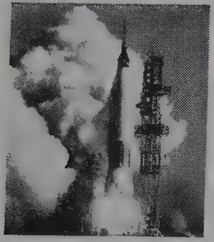
List of Military Specifications and Standards (ASESA List No. 100, Issue No. 55, 1 June 1961). Supersedes Issue No. 54 dated 1 February 1961.

Mil-C-20D, *Capacitors, Fixed, Ceramic Dielectric (Temperature Compensating).* Supersedes Mil-C-20C dated 11 September 1959.

Mil-R-93C, *Resistors, Fixed, Wirewound (Accurate).* Revision C of Mil-R-93B dated 31 March 1958 supersedes Mil-R-9444A (USAF) dated 20 July 1959.

Mil-R-11D, *Resistors, Fixed, Composition (Insulated).* Supersedes Mil-R-11C dated 31 March 1958.


Between yesterday's dream and today's reality



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Burlington

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Association News

Butyl Rubber Wire and Cable Insulation Symposium Set for Fall AIEE Meeting

A technical symposium on butyl rubber wire and cable insulations has been scheduled for October 20, 1961, at the Statler-Hilton Hotel in Detroit, as part of the fall general meeting of the American Institute of Electrical Engineers.

The results of a recently completed, nation-wide butyl insulation survey will be reported for the first time at the meeting. The survey sought data on field experience with butyl insulations among utilities as well as industrial and commercial users of the material. The following papers will be presented: *Electrical Characteristics of Butyl Rubber Insulations at 125°C* by N. D. Kenney, T. N. Metropolus, and W. L. Seamonds, Simplex Wire & Cable Co.; *Continued Evaluation of Butyl Rubber Insulated Cables* by J. R. Maher and J. C. Carroll, General Electric Co.; *Some Factors in the Short Time Dielectric Strength of Butyl Insulated Cables,* by W. A. Beasley, Anaconda Wire and Cable Co.; *Butyl Rubber Network Cables for 260°C Limiter Operations,* by R. H. Carlson, American Steel and Wire Co.; *Development of Butyl Rubber Insulated Buried Airport Lighting Cables,* by R. C. Graham and S. R. Lynch, Rome Cable Co.; *Design and Manufacture of Butyl Rubber Insulated Dredge Cables* by P. Gibbon and J. Campbell, Northern Electric Co.; and *Survey of Utility and Industrial Users of Butyl Rubber Insulated Cables* by D. Cronin, Ebasco Services Inc., R. E. Hoy, Enjay Chemical Co., and E. Johnson, Philadelphia Electric Co.

BIDDLE INSTRUMENTS

DIELECTRIC TEST EQUIPMENT

40 KV Model is a one-man portable set for maintenance d-c tests. Maximum safety built in. Simple operation. Reliable performance. You get excellent output voltage with facilities for voltage and leakage current measurements.

Also available: model for operation up to 100 KV and another for operation to 5 KV. Useful for development work to test d-c dielectric strength of insulating materials and adequacy of design of insulation in equipment; also in production tests for nondestructively detecting defects in electrical insulation.

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Hardenbrook to Keynote Standards Conference

Donald J. Hardenbrook, vice president of the National Association of Manufacturers, will deliver the keynote address on October 10 at the opening session of the 12th National Conference on Standards in Houston, Texas.

Discuss Molecular Electronics at Printed Circuit Meeting Oct. 11

"How close are we to thin film micro-circuitry or molecular electronics?" That is one question which will be raised during the Fall Symposium of the Institute of Printed Circuits, to be held at the Sheraton Hotel, Chicago, October 11, 1961. Discussions will be centered on the practical business aspects of what is generally referred to as molecular electronics in an effort to gain a better concept of the role printed circuits will play in the future plans for electronic packaging. The symposium will be open to all who are interested in the subject.

For additional information, write to the Institute of Printed Circuits, 27 E. Monroe, Chicago 3, Ill.

Location Changed for NEMA Annual Meeting

The 35th annual meeting of the National Electrical Manufacturers Association will be held at The Plaza, Fifth Avenue and Fifty-ninth Street, New York City, instead of at New York's new Summit Hotel, as originally scheduled. The date remains the same . . . November 16, 1961. Division and Section meetings scheduled for Summit during week of November 12 will not change locations.

The November 16 program will be divided into two parts—a morning business session, and a dramatic review of the electrical industry's progress immediately after the general membership luncheon.

Manufacturing Chemists Meet Nov. 21

The 11th semi-annual meeting and midyear conference of the Manufacturing Chemists' Association Inc., will be held Nov. 21, 1961, in New York City.

Nineteen Engineering Societies Move To New Center on UN Plaza

Over the Labor Day weekend 19 organizations moved to the new 20-story, $12,000,000 United Engineering Center on United Nations Plaza, between 47th and 48th Streets, New York City.

The Center is said to be the largest concentration of professional engineering societies in the Free World. The occupants include the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, Engineering Foundation, Engineering Index, Engineering Societies Library, Engineers Council for Professional Development, and Engineers Joint Council.

New National Officers for ASTM

Miles N. Clair, The Thompson & Lichtner Co. Inc., has been elected president of the American Society for Testing Materials.

Alfred C. Webber, E. I. du Pont de Nemours and Co. Inc., was elected vice-president, and R. Wade Seniff, The Baltimore and Ohio Railroad Co., continues as senior vice-president.

New members of the Board of Di-

"B" STAGE POLYESTER-SATURATED GLASS FABRIC

VARTEX

BP-1064

INSULATING TAPE WITH BUILT-IN ABILITY!

BP-1064, a woven Fiberglas tape impregnated with polyester resin is processed to the "B" Stage and possesses outstanding mechanical, thermal and electrical insulating properties. Since no interliner is required, this highly flexible tape can be applied rapidly and efficiently for conformable wraps on form coils, banding, or armoring. Rigidly self-adhesive when heat-cured to the "C" Stage, BP-1064 becomes insoluble and infusible with a high degree of compactness. It is compatible with a variety of curing agents and systems and has excellent shelf life . . . in excess of six months if stored at temperatures not over 80° F.

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rectors elected for three-year terms are: Ardrey M. Bounds, Superior Tube Co.; Albert G. H. Dietz, Massachusetts Institute of Technology; Bruce W. Gonser, Battelle Memorial Institute; Wayne A. Kirklin, Hercules Powder Co.; Gordon M. Kline, National Bureau of Standards; and James B. Rather, Jr., Socony Mobil Oil Co. Inc.

Wire and Cable Symposium To Be Held Nov. 29-Dec. 1

The tenth annual Wire and Cable Symposium jointly sponsored by the U.S. Army Signal Research and Development Laboratory and industry, will be held at the Berkeley-Carteret Hotel, Asbury Park, N.J., on Nov. 29–Dec. 1.

Some 25 technical papers will point out progress in various phases of the field of communication wires and cables.

ASTM Grants Honorary Memberships

Named to Honorary Membership in the American Society for Testing Materials—the Society's top award to a member—at the summer annual meeting were the following:

William A. Zinzow (retired assistant director of development, Bakelite Co.), in recognition of long and constructive technical and administrative support of the Society, and particularly for outstanding leadership in and contributions to the fields of plastics, rubber, and electrical insulating materials.

Edward J. Albert, chairman of the board, Thwing-Albert Instrument Co., in recognition of long and valuable support of the Society in technical and administrative areas, and for loyal service through work in the Philadelphia District when acting as host for annual meetings.

Simon Collier, quality control consultant (retired director of quality control, Johns-Manville Corp.), in recognition of long and notable contributions to the Society in both technical and administrative activities, especially for eminent leadership and work in the fields of rubber and rubber-like materials, and quality control.

Baechle Is New EASA Executive Vice President

August A. Baechle has been appointed executive vice president of the Electrical Apparatus Service Association Inc. He had been acting in that capacity since May 2.

NEMA Insulating Materials Division Elects Officers

E. R. Perry, National Vulcanized Fibre Co., has been elected chairman of the Insulating Materials Division of the National Electrical Manufacturers Association.

The Division also elected the following two vice chairmen: D. J. O'Conor, Jr., Formica Corp., subsidiary of American Cyanamid, and R. L. Westbee, Minnesota Mining and Manufacturing Co.

The following officers were elected by the product sections within the Division:

Coated Electrical Sleeving Section—W. H. Bentley, Jr., Bentley-Harris Mfg. Co., chairman; John H. Goetz, Suflex Corp., vice chairman; W. J. Dwyer, Suflex Corp., chairman of General Engineering Committee.

Industrial Laminate Section—H. C. Smith, Westinghouse Electric Corp., chairman; Walter A. Smith, vice chairman; J. J. Pyle, chairman of Technical Committee.

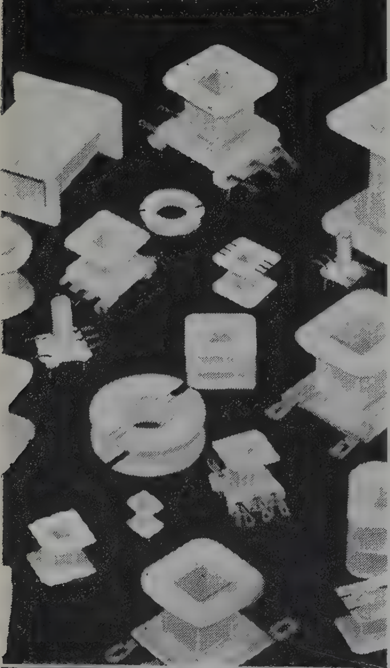
Manufactured Electrical Mica Section—E. O. Hausmann, Continental-Diamond Fibre Corp., chairman; H. A. Letteron, General Electric Co., chairman of Technical Committee.

Flexible Electrical Insulation Section—Lloyd N. Smith, New Jersey Wood Finishing Co., chairman; H. G. Steffens, Natvar Corp., chairman of Technical Committee.

Vulcanized Fibre Section—E. H. Da Costa, Taylor Fibre Co., chairman; M. R. Stokes, Brandywine Fibre Products Co., vice chairman; R. R. Hydeman, Taylor Fibre Co., chairman of Technical Committee.

Lloyd N. Smith, New Jersey Wood Finishing Co., was elected to the Insulating Materials Division's Board of Directors representing the Flexible Electrical Insulation Section. He replaces Erwin W. Brown, Irvington Electrical Div., Minnesota Mining & Manufacturing Co. Other members of the board were re-elected.

AMERICAN MOLDED



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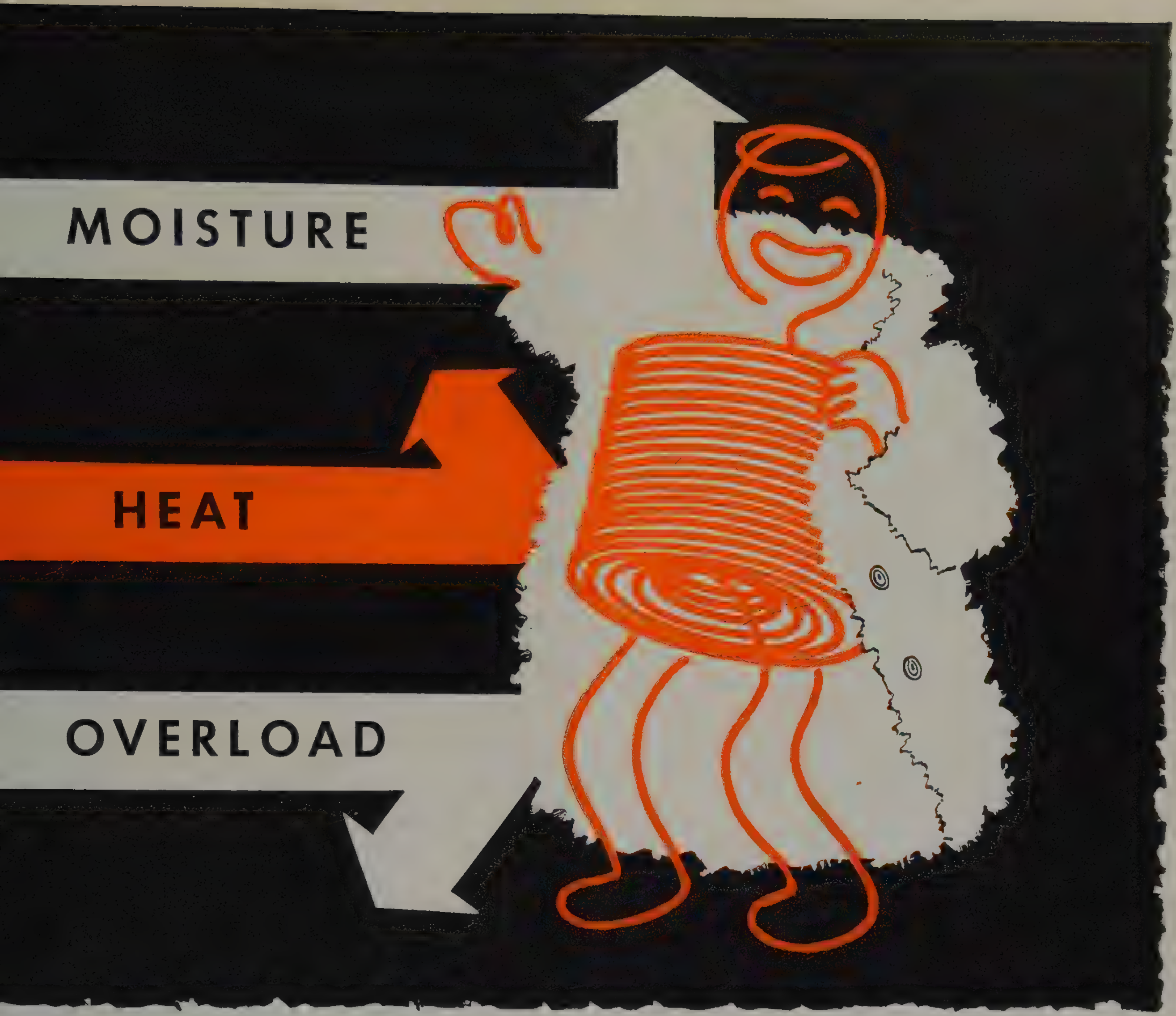

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at's right . . . now you can extend your use of FORMVAR ed wire enamel to Class B systems. The method is simple. rely impregnate FORMVAR based wire enamel with one of newer commercially available impregnating varnishes. The nbination offers increased thermal stability of the entire tem—and you get all of the proved advantages of FORMVAR. cellent windability, high overload resistance, and resistance heat, moisture, cut-through and abrasion.

This technique to upgrade thermal stability has been proved use. Shawinigan has always been first with new developnts, new applications and technical assistance for the e industry. Twenty years background in producing polyvinyl formal resin—the basic ingredient in *all* FORMVAR based wire enamel—assures you of the best in products, the best in service. For more information on the easiest, most dependable combination of commercial varnish overcoat and FORMVAR based wire enamel, write Shawinigan Resins Corporation, Dept. AQ, Springfield 1, Massachusetts.

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Nemcoite Mica Tubing and Bushings

STANDARD — RECTANGULAR — SPECIAL SHAPES

STANDARD MICA TUBING BONDED WITH SHELLAC

Tubular insulation and Bushings of high mechanical and electrical strength for grids, rheostats, resistance boxes, etc., are made in any desired shape: round, square, oval, hexagonal, octagonal, etc., and in any diameter and wall thickness.

SUPER-NEMCOITE MICA TUBING

A tubular insulation suggested for use in grids, rheostats, and resistance boxes. This type comprises mica splittings and a synthetic resin binder, and is characterized by greater heat stability, excellent electrical insulating characteristics, and high chemical resistance and durability. This type of tubing with a covering layer of electrical asbestos provides an excellent combination tube.

SILICONE-BONDED MICA TUBING

Tubular insulation and Bushings of high mechanical strength, thermal stability, electrical insulation value, and resistance to the action of chemicals, weather and moisture. They comprise mica splittings or mica paper bonded with silicone resins and are designed for use as Class H insulation.

RECTANGULAR TUBES – OTHER SHAPES

In addition to the standard forms of round tubing and bushings, rectangular and other shaped tubing is supplied to specified dimensions.

NOW...

A comprehensive brochure on various types of mica insulation is available. A copy of this helpful reference will be sent on request.

NEW ENGLAND Mica CO.
INCORPORATED
Waltham 54, Massachusetts
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Pixilated Patents

By Mike Rivise

Fifty-eighth in a series of odd and interesting inventions in the electrionics field from the files of the U.S. Patent Office.

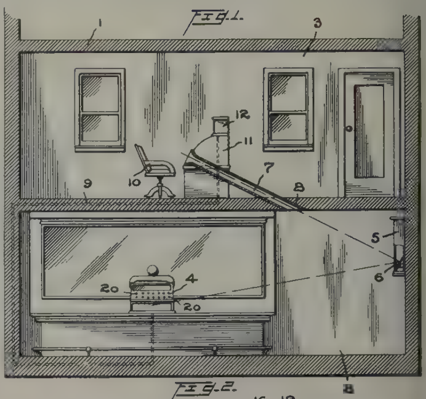
Bartenders who feel that they are traditionally privileged to slip their friends free drinks would undoubtedly label the device covered by this month's patent an unfair management practice.

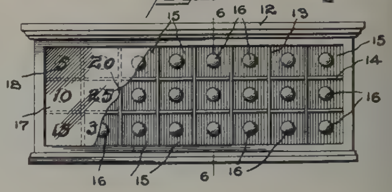
Patent 1,192,095 granted to Henry Muller of Philadelphia on July 25, 1916, related to "improvements in fraud detectors, the object of the invention being to provide improved means for showing at a distance the entire operation of a cash register, so that the proprietor of a business can, in another room, not only observe the employee, but can have before him an accurate reproduction of the operation of the cash register, so that he can instantly detect fraud of any kind."

Apparently it was designed for proprietors with a lot of time on their hands . . . or for those with pretty girls operating the cash register.

Basically, the invention consists of an electrical hook-up for cash registers which will light appropriate bulbs in a remote indicator when the keys of the cash register are depressed, and a tube with or without a mirror arrangement which will allow the proprietor to see what is going on in his place of business. Figure 1 shows a set-up for a bar with an office above. Figure 2 illustrates the remote electric indicator which is controlled by the cash register.

The electric indicator consists of a casing divided by vertical and horizontal partitions into as many compartments as there are indicators on the cash register. A transparent cover has a numeral on it above each of the compartments which corresponds to the amount of the cash register key which lights the bulb in that compartment.





With these improvements, Muller assures us, "the cheapest forms of cash register can be used, and the proprietor will know of a surety whether or not any fraud is being perpetrated upon him." It is necessary, however, for the proprietor to keep one eye on the electric indicator and the other on the spy tube.

Ceramic Materials For Missiles

A process for making simple or complex geometric shapes from honeycomb ceramic sandwich constructions and a mechanical method for the continuous fabrication of ceramic corrugated ribbon or sheet have been developed as part of a program to utilize ceramic and other refractory inorganic materials in the construction of rockets and missiles.

The techniques are described in an Air Force research report released to science and industry through the Office of Technical Services, Business and Defense Services Administration, U. S. Department of Commerce, Washington 25, D. C. Order PB 171 148, *Refractory Inorganic Materials for Structural Applications: Part 2,* by H. A. Pearl and others, Bell Aircraft Corp. July 1960, 95 pages, $2.25.

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Print Ins. 17 on Reader Service Card

New Materials and Components

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Amorphous Polypropylene Has Unusual Physical Properties

A new polypropylene material is said to have the following combination of characteristics: It's sticky, it stretches, it's easily melted, it's compatible with a number of other resins and with most waxes, and it's soluble in most aromatic and aliphatic solvents. An amorphous polypropylene of low molecular weight, the new product is currently available in two grades; one, a tacky elastomer; and the other, in physical form similar to a moderately heavy grease. Preliminary evaluations have shown them to be of promise in hot-melt adhesive blends for laminating and sealing and in caulking and potting compounds. Their unusual physical properties and wide compatibility have also produced some novel blends with a number of waxes and other resins. In many applications so far, the elastomeric type has imparted flexibility to olefin waxes and resins. Eastman Chemical Products Inc., subsidiary of Eastman Kodak Co., Chemicals Div., Kingsport, Tenn.

Print No. Ins. 100 on Reader Service Card

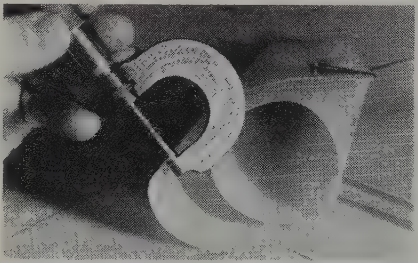
Polyurethane-Base Insulating Coating For Printed Circuit Boards

New polyurethane-base insulating coating, designated "HumiSeal" type 1A28, is designed for use on printed circuit boards. Manufacturer states it offers ease of application and cure, is solderable, eliminates the need for costly and time-consuming stripping, and recommends it for use in the —70 to +250°F (—56.7 to 121°C) temperature range. Columbia Technical Corp., Woodside 77, N. Y.

Print No. Ins. 101 on Reader Service Card

Epoxy/Polyester Sheet for Class B Layer and Wrapper Insulation

A new class "B" layer and wrapper insulation, epoxy varnished non-woven "Dacron" sheet, is said to be thin and tough, with a uniform thickness that assures freedom from voids. Thin gauges of .0025″ and .0055″ reportedly permit savings of space and weight and simplify handling. The material is expected to be used in place of 2-ply and 3-ply combinations in some instances. Excellent crease and cuffing properties, good tear and cut-through characteristics, and high dielectric strength (average breakdown of 1900 vpm across .0025″ sheet with ¼″ electrodes; 1600 vpm on .0055″ sheet) are reported. Westinghouse Electric Corp., Micarta Div., Trafford, Pa.



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Semi-Conducting Polyethylene Shields Wire and Cable

A semi-conducting polyethylene resin for replacement of fabric shielding on high voltage cabling may be applied as an extruded layer or as

NOW...

**Terafilm—an important new polyester film—comes to you from a new, controlled-atmosphere plant.
Here's what this means:**

Terafilm is a remarkable new plastic development. Dimensionally stable, it has superior resistance to moisture and heat. Electrical insulating properties are outstanding. Capacitors wound with **Terafilm** were left uncased and subjected to temperature and humidity conditions under which capacitors wound with another polyester film deteriorated completely in eight days. After 21 days, those wound with **Terafilm** were still intact.

Terafilm also accepts printing and metalizing, has excellent chemical resistance, and can be laminated to other materials. Thus, its possibilities range over packaging, magnetic tape, metallic yarns, and other functional and protective electrical applications—wire, cable, capacitors, coils, slot liners, tape...

Rigid quality control is the key to the outstanding performance of **Terafilm.** It is made of Eastman Tenite Polyester in a dust-free controlled atmosphere employing the most precise production techniques. You can expect its quality and service properties to conform to the most exacting standards. **Terafilm** is available in any quantity you desire, and for samples of the film or sheet, and detailed information at no obligation, write today.

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TODAY...

Tenite Polyester—a remarkable new plastic—
is being made into an important new film.
Here are some facts you should know:

With Tenite Polyester, Eastman launches a new plastic material. Today, it is already being made into biaxially oriented film by Terafilm Corporation, Stamford, Connecticut. This is an extraordinary plastic film—an extraordinary *polyester* film.

It can be applied to many of the familiar uses for plastic films. But it will also accomplish many unusual tasks with impressive results, chiefly because Tenite Polyester itself possesses such unusual properties. This table will give an idea of some test results:

Typical Physical Properties of 1-mil Film

	25°C	−50°C
Density, g/cc	1.226	
Refractive index	1.59	
Tensile—Yield Strength, psi	10,000	15,000
Strength at break, psi	17,000	20,000
Elongation at break, %	45	40
Modulus, 10^5 psi	4.0	4.5
Tear strength, g/mil	6	
M.I.T. fold endurance, cycles	10,000	
Burst strength, psi	56	
Moisture absorption—24 hr at 25°C, %	0.3	
Water vapor permeability—g-mil/100 in^2/day	1.8	
Flammability	Will not sustain flame due to melting (ASA burning rate)	
Color	Brilliant water-white	
Resistance to degradation by steam—	No change after 8 days at 110°C and 100% R. H.	
Heat-distortion temperature, 2% at 50 psi	170°C	
Dielectric strength, 1-mil, 500 v/sec, 60-cycle	6,500 v/mil	
.5-mil, 500 v/sec, 60-cycle	9,000 v/mil	
Corona resistance, 1-mil, 2,000 volts, 60-cycle	150 minutes	
Insulation resistance, 100°C, 100 volts, 5-min electrification	$> 10^4$ megohm microfarads	
Dissipation factor, 1.0 kc, 100°C	0.006	
Capacitance increase, %, 100°C	2.0	

You might compare these figures with those on hand for any other plastic film. But there are additional facts well worth knowing, and they can best be evaluated by seeing the film and reading about what it can do. Generally, the story adds up to this:

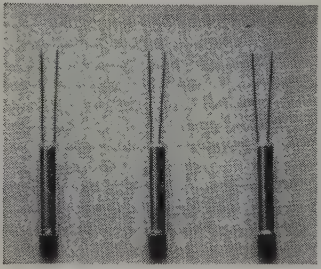
New Electrical Benefits

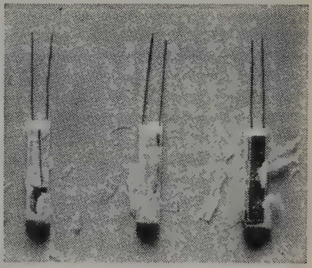
Film of Tenite Polyester is brilliantly clear and glossy. It has excellent dimensional stability along with high heat-distortion temperature and low moisture absorption. Its electrical properties are most impressive.

Film made from Tenite Polyester possesses a high dielectric strength along with an extremely stable dissipation factor and dielectric constant. These properties, together with its excellent resistance to chemicals and moisture, provide important new benefits when the film is used as an insulating winding for wire, cable, capacitors, and coils, and as slot liners and tape. Dielectric constant of the film is about 3.1, while a typical value for dielectric strength is 9000 v/mil at 60 cycles and 500 v/sec for 0.5-mil film.

Unusual Performance

Eastman laboratories tested capacitors made from film* of Tenite Polyester in comparison with those made of another polyester film. In both tests, the capacitors were uncased and were held at 110°C and 100% humidity. Results after eight days are shown here. After 21 days of this treatment, the capacitors made from Tenite Polyester were still intact. The properties demonstrated by these tests mean substantial savings in making capacitors; the case of a conventional capacitor is a major item in its cost.


Tenite Polyester


Other Film

Similar uncased capacitors were made with film of Tenite Polyester for a commercial TV set, an electric organ, two radios, and several industrial controllers. The TV set is programmed to run nine hours per day, the organ 24 hours per day, and the radios and controllers are in intermittent service. Since testing began some three years ago, not a single failure or defect in operation has occurred.

See for Yourself

These properties of Tenite Polyester hold many new and desirable advantages for the electrical and electronic industries. In making your own appraisal of the film firsthand, you may wish to have samples and detailed information. Just write Terafilm Corporation, Canal and Ludlow Streets, Stamford, Connecticut, extruders of Tenite Polyester supplied by EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

*"A New Polyester Dielectric for Capacitors," Richard G. Devaney, *Insulation*, April, 1961.

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POLYESTER
an Eastman plastic

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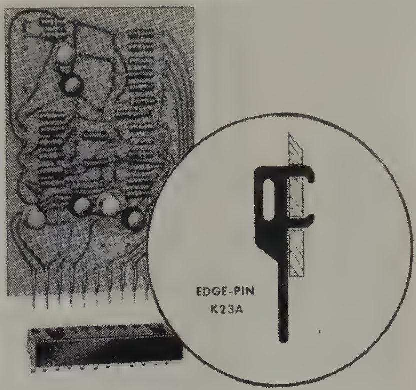
wrapped tape. Developed to meet requirements of the Minuteman missile, "Alathon" 2900 BK 50 high density polyethylene resin is used primarily as an electrostatic shield on insulated wire and cables for control and communications. The resin's semi-conducting nature spreads an electrical charge—from lightning, for example—over a large cable area. This distribution reduces the chance of a hole being blown in the cable jacket. Other projected uses for the resin include extruded or molded parts which must be free of static electricity. The copolymer reportedly resists cracking when bent, despite high carbon content, and has passed ASTM environmental stress crack standards. Other properties reported include toughness; flexibility at low temperatures; and moisture, corrosion, and chemical resistance. Polychemicals Dept., E. I. du Pont de Nemours & Co. Inc., Wilmington, Del.
Print No. Ins. 103 on Reader Service Card

Alkyd Molding Materials For Electronic Applications

Two new molding materials, "Plaskon" alkyds 541 and 428, are electronic grade materials. AMC-541, based on a diallyl phthalate resin, is glass fiber reinforced and flame retardant. It reportedly conforms to the new Type GDI-30F of Mil-M-19833. The AMC-428 is said to be a fast curing, glass-filled granular material featuring stability of dielectric constant at varying temperatures. Data reports and price list available. Plastics Div., Allied Chemical Corp., 40 Rector St., New York 6.
Print No. Ins. 104 on Reader Service Card

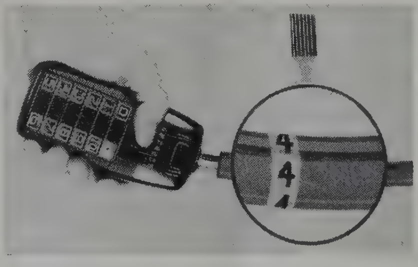
Circuit Board Connector Devices

New connector devices for circuit boards, Edge-Bord and In-Bord pins and cup receptacles, allow the user to mount only the number of contacts actually required. They are said to make possible creation of plug-in circuit boards at lower cost than with many other methods. The Edge-Pin mounts with two staked legs near the edge of any 1/16″ circuit board. Round 0.040″ diameter pins project about ¼″ beyond the board edge. To receive the pins, new cup receptacles can be installed on a "mother" board or molded block receptacles are available to accommodate circuit boards with 10, 15, or 20 installed Edge-Pins on 0.156″ or 0.2″ spacing. The components may be used with printed circuits or manually wired boards. Another member of the family is the In-Board connector pin which is staked perpendicularly to any board surface. Small "piggy-back" plug-in boards can be created using as many In-Bord pins as required and then the assembly may be plugged into a "mother" board in which cup receptacles have been installed. Alternately, the "piggy-back" boards with installed In-Bord pins can be dip-soldered to eyelets. Samples available. Vector Electronic Co. Inc., 1100 Flower St., Glendale 1, Calif.
Print No. Ins. 105 on Reader Service Card



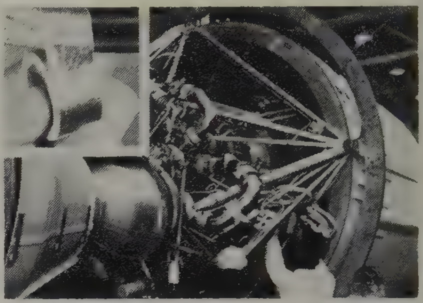
Circuit Markers

Designed to be used in conjunction with the new Amprobe cable tracer—an instrument which is claimed to allow one man to trace and identify circuits 10 times faster than any previous method—new wire markers, called Trace-Tabs, enable an electrician to mark both ends of up to 50 circuits quickly and easily. Trace-Tabs are divided strips (numbered from 1 to 10), printed on a colored, adhesive-backed cloth tape. The tape is affixed to a cardboard stiffener. Each numbered strip is further subdivided in half to permit the marking of both ends of a conductor. Trace-Tabs are sold in packages of 10 cards: two each of five contrasting colors (green, orange, blue, yellow, and white). Price is $2. Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, N.Y.
Print No. Ins. 106 on Reader Service Card



Reflective Tape Shields Electrical/ Electronic Parts from Extreme Heat

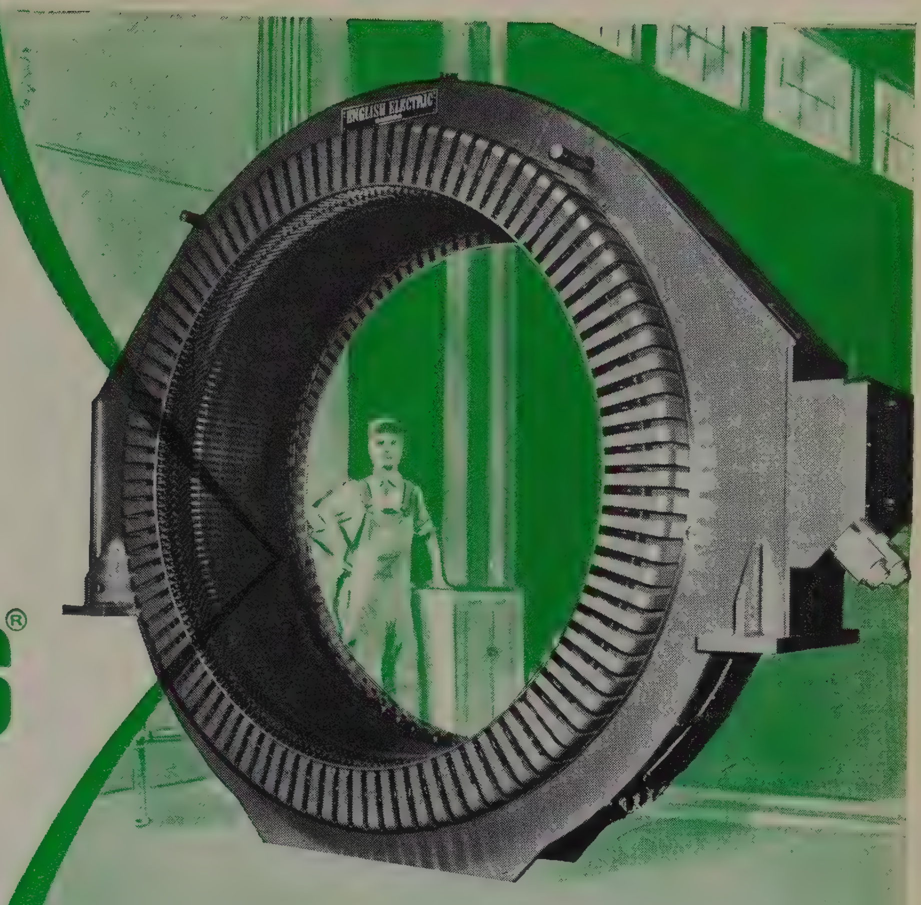
A pressure-sensitive tape designed to reflect extreme heat from motors, wires, and delicate structural parts, called "Scotch" brand No. Y-9050 heat reflective tape, is said to be capable of performing continuously at temperatures of 500 to 600°F, and to withstand more than 3000°F of radiant heat for short periods. The new glass cloth-aluminum foil tape is also stated to be easy to handle and so durable that it can be spiral-wrapped with no damage to the reflectance. Caliper of the tape, which is readily conformable to irregular shapes, is only .006″. Weight is .0038 lb/ft/in of width, with tensile strength of 75 lbs/in of width. Tape is a lamination of .0005″ aluminum foil to .002″ glass cloth coated with a white silicone adhesive to assure high temperature operating properties. Considered excellent for covering such components as electrical control cables, wire harnessing, and circuits, the tape has been used on such space "birds" as the Titan missile and for the Project Mercury program. Dept. Jl-1, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.
Print No. Ins. 107 on Reader Service Card



Catalyst Improves Epoxies

A new catalyst to be used as an activator in anhydride cures for epoxy systems is said to greatly prolong pot life, to shorten cure time and give sharper and more perfect cures, and to extend high heat operating

ENGLISH ELECTRIC CANADA USES NATVAR Teraglas® TO TAPE STATOR COILS OF THIS 4500 HP MOTOR



This unit, one of four built by English Electric for export to Europe, is a 4500 HP, 6000 V, 3-phase, 50 cy. synchronous motor stator. Coil ends are taped with Natvar Teraglas, a new flexible insulating material comprising a base fabric woven from polyester (polyethylene terephthalate or "Dacron") warp yarns, and continuous filament glass filler yarns, coated with an improved varnish possessing exceptional dielectric strength under elongation.

English Electric Canada, Toronto, Ontario, Division of John Inglis Co. Ltd. manufacture electrical motors, controls, transformers and switchgear for use in important installations throughout the world.

They have found that Teraglas offers several distinct advantages over the thirsty cotton base tapes formerly used. At no advance in material cost, Teraglas is more readily applied to coils; the higher dielectric strength of Teraglas results in a better insulated coil; and better heat resistance provides a greater safety factor against high operating temperatures due to overloading.

If you are presently using conventional materials, it will pay you to consider the ease of use and extra protection of Teraglas. It is made in four standard thicknesses, .008", .010", .012" and .015", available in sheets, rolls or tapes in black and yellow.

Teraglas® U.S. Pat. Off. (Natvar Corp.)

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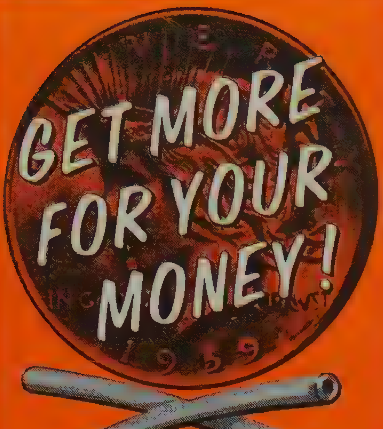
- Varnished, silicone varnished and silicone rubber coated Fiberglas*—sheet and tape
- Slot cell combinations, Aboglas®
- Teraglas®
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated and silicone rubber coated Fiberglas tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape

*TM (Reg. U.S. Pat. Off.) OCF Corp.

We will be very happy to supply information on any of our products on request.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Let PENNSYLVANIA FLUOROCARBON fill your order and you can be sure of getting what you pay for—and more! This tubing is *more reliable, longer lasting, easier to use* because it:

- *More than meets S. P. I. Spec. F. D. 103 and MIL-I-22129B*
- *Shrinks less than 1% so it won't expose terminals*
- *Is properly cured—has a tensile strength between 2500 and 6000 psi at 200% elongation*
- *Is not stiff and brittle*
- *Is cleaned and 100% inspected*

PF spaghetti tubing of Teflon is available, from stock, in a wide range of standard and special sizes and wall thicknesses and in colors for identification. It is used as sheathing for wire, as slip-on insulation and bushings and in many other applications where these properties are important:

- good dielectric strength (1000—2000 volts/mil)
- lowest dielectric constant (2.0) and dissipation factor (0.0002) of any solid dielectric.
- no change of electrical properties with temperature (—25°C to +250°C) or frequency (60 cycles to 100mc)
- unaffected by moisture
- unharmed by soldering irons

Write, wire or call and let us quote on your requirements.

You can be sure you get what you pay for in Teflon when you order from

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qualities of all anhydride systems. It is called Catalyst 215X and operates in any anhydride system at 2.5 to 5% level on resin. Isochem Resins Co., 221 Oak St., Providence 9, R.I.

Print No. Ins. 108 on Reader Service Card

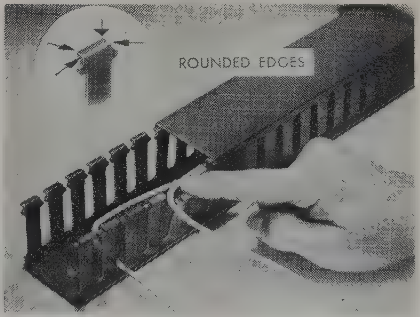
High Temperature Epoxy Impregnating Compound

"Isochemfil" 211 is an improved unfilled, low viscosity 100% epoxy impregnating resin system designed for use where high heat stability coupled with excellent physical and chemical properties are required. It is said to convert mechanically weak and porous structures into strong, moisture impervious, and chemically resistant material. When properly cured, it reportedly can be operated for extended periods at 500°F with no loss of physical characteristics. Long pot life (2-4 weeks), excellent adhesion, excellent electrical characteristics, and stability toward chemical attack are claimed. Isochem Resins Co., 221 Oak St., Providence 9, R.I.

Print No. Ins. 109 on Reader Service Card

Plastic Duct Has Rounded Edges For Wire Insulation Protection

A newly developed open-slot plastic wiring duct, available in 25 sizes, is designated Type E Panduct. The new design incorporates rounded top surfaces on the duct which protect wire insulation and prevent irritation of the installer's hands. The duct is easily cut with a saw. Corners can be mitered at any desired angle. Modular corner, tee, transition and straight-through fittings are available. Mounting can be accomplished by means of an ordinary screw through a hole drilled in the duct base, with snap type spring clips or with a threaded stud which secures both duct and duct cover. Type E duct is molded from tough, non-flammable vinyl plastic that will not support fungus growth or irritate the hands of installers. It reportedly meets J.I.C. requirements and is approved by the Canadian Standards Association. Panduit Corp., Dept. IN-2, 17301 Ridgeland Ave., Tinley Park, Ill.



Print No. Ins. 110 on Reader Service Card

Insulated Terminals Provide More Rigid Assemblies

An extended line of Press-Fit "Teflon"-insulated stand-offs, terminals, feed-through, and turret-type component hangers is designed for use in chassis of approximately .048" thick and reportedly provide greater rigidity for assembly convenience and increased equipment reliability. The terminals require a slightly larger mounting hole for the Teflon body. The metal stud running through the Teflon body is a heavier design than normally used. The resulting installation provides greater mechanical stability for both wiring and component mounting. Sealectro Corp., 610 Fayette Ave., Mamaroneck, N.Y.

Print No. Ins. 111 on Reader Service Card

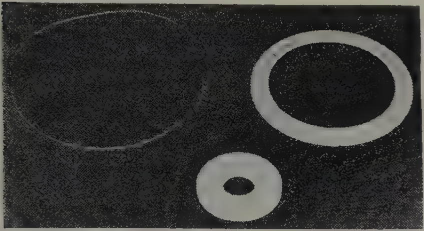
Vinyl Color Concentrates with Increased Volume Resistivity

Marked improvements in electrical properties are reported for a new "E" series of electrical grade vinyl color concentrates which are said to be particularly suited for 60°C T and TW and 75°C THW applications. A 100 to 200% increase in volume resistivity is claimed in addition to even color dispersion, rapid and full dispersion under heat, maximum color power per pound, and excellent heat stability and light fastness. The Blane Corp., Canton, Mass.

Print No. Ins. 112 on Reader Service Card

"Kel-F" Resins for More Reliable Molded And Extruded Insulations to 400°F

A new thermoplastic resin, labelled "Kel-F" 81, has been formulated to provide consistent processing and to produce a greater degree of reliability in finished parts. The resin is offered in two grades (based upon molecular weight) varying in pelletized and unpelletized and plasticized forms, incorporating some of the physical and mechanical properties of standard Kel-F polymers. Important qualities of products made from the resins reportedly include: thermal stability from —400° to +400°F; abrasion resistance; resistance to a wide range of chemicals, fuels, and corrosive media; excellent electrical properties; infrared transmission qualities; and zero moisture absorption. In addition, and depending upon the size or thickness of the particular product requirements, a highly crystalline or highly amorphous condition may be induced by special heat-treating techniques. Particularly important to processors are the outstanding low temperature properties of the material, which is stated to remain flexible and tough even at liquid oxygen and liquid hydrogen temperatures. Resistance to corrosives makes the plastic an important engineering material in the fields of missiles and rockets, as well as in conventional applications in electric and electronic configurations. On-the-job testing by molders throughout the United States is said to indicate that the new material provides a sharper melt temperature, less resistance to flow, and a greater hot melt strength than comparable resins, providing a better control in molding. Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.



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Vulcanized Fibre Covered With Clear Plastic Film

A new material called "Fibrite" is a plastic consisting of hard vulcanized fibre with a bonded covering of clear plastic film. The combination reportedly enhances fibre's usual rugged physical and high dielectric characteristics with increased flexural strength, improved flatness and appearance, and lower moisture absorption. The plastic film also has high dielectric strength. It is resistant to solvents and grease and has a temperature service range from —40° to 200°F (—40°C to 93°C). It can be heat sealed to itself. Fibrite is said to be particularly suited to large parts and thicknesses of 3/32" and over in applications where impact strength and moisture or arc resistance are required. Spaulding Fibre Co. Inc., 310 Wheeler St., Tonawanda, N.Y.

Print No. Ins. 114 on Reader Service Card

Polyethylene Resin Coats 4,000 Feet Of Wire or Cable per Minute

A polyethylene resin has been developed which can be extruded to give telephone and control cables exceptionally smooth insulation coatings at speeds as high as 4,000 ft/min. It is known as "Alathon" 3530 polyethylene resin. Wire insulation produced with it reportedly has excellent electrical properties, fine aging properties, toughness and flexibility at low temperatures, and moisture resistance. Thin wire insulations of 3530 applied at high speeds are said to be exceedingly smooth. Laboratory measurements on 10-mil coatings over No. 22 AWG, applied at 3,800 ft/min, deviate an average of only 13 microinches from a normal diameter. Since the molecular weight of 3530 polyethylene resin is higher than general purpose

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Higher performance ratings in recently introduced rectifier designs have placed higher demands on rectifier **housings.** Ceramaseal high-alumina housings provide the answer — with these advantages over glass:

PERMIT HIGHER TEMPERATURES
Ceramaseal housings remain high-vacuum tight during continuous operation at 350 C in air.

SURVIVE TOUGHER OPERATION
Housings by Ceramaseal withstand greater mechanical and thermal stresses than glass without cracking or failure of high-vacuum-tight seal.

PROVIDE LONGER CREEPAGE PATHS
In compact housing designs, high-alumina ceramic provides longer creepage paths than glass.
You can apply Ceramaseal housings with conventional welding methods. For information on your application, write:

Hermetic Ceramic Terminals, Magnetron Wells, Sapphire-to-Metal Seals

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NEW LEBANON CENTER, NEW YORK

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insulating polyethylenes, its melt index of 0.3 is lower. Stock temperatures in the range of 400 to 450°F have provided good coatings. Polyolefins Div., Polychemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

Print No. Ins. 115 on Reader Service Card

Glass/Melamine Laminate for Electrical Apparatus and Appliances

Industrial "Textolite" 11588 laminate has been developed primarily for use by electric apparatus and appliance manufacturers. However, its unusual combination of properties makes it ideal for a number of electrical and electronic applications. New 11588 is said to equal or surpass many of the characteristics of epoxy-based laminates, at a lower cost. Excellent moisture resistance and flexural strength qualities are reported in addition to high arc resistance, good impact resistance, flame retardance, and dielectric strength. This glass-cloth, melamine-resin laminate is available in a semi-gloss finish in a sheet thickness range from .015″ to 3.5″. Laminated Products Dept., General Electric Co., Coshocton, Ohio.

Print No. Ins. 116 on Reader Service Card

Room Cure Epoxy Adhesive For Use at 400°F

New room temperature curing adhesive for service at 400°F (204°C) consists of an epoxy paste and a powdered curing agent. The new adhesive, No. 810, reportedly provides excellent adhesive strength at temperatures up to 400°F, maintains good adhesive properties for service lives in excess of 200 hrs at 400°F, and will also withstand short exposures to 500°F. It has a pot life of 15 minutes at room temperature, and cures in thin glue lines in 24 hrs, though several days to a week are required for maximum development of adhesive strength. Heat may be used to speed cure. The Epoxylite Corp., 1428 N. Tyler, South El Monte, Calif.

Print No. Ins. 117 on Reader Service Card

Polyester Resins for Heat Resistant Conductor Coatings

New series of polyester plastics comprising a mixture of dextran-modified resins and metallic compounds of zinc, cadmium, lead, and similar metals has been developed for the heat-resistant coating and insulation of electrical conductors. These flowable plastics are said to be a substantial improvement over conventional insulation enamel. The plastic coating, unlike enamel, reportedly is non-cracking and virtually abrasion-proof, remaining unaffected by heat generated in electrical mechanisms and circuits. These plastics (Pat. No. 2,843,553) are expected to give longer and more reliable service wherever a tough, non-conductive coating is required on metals and other materials. The Commonwealth Engineering Co. of Ohio, 1771 Springfield St., Dayton 3, Ohio.

Print No. Ins. 118 on Reader Service Card

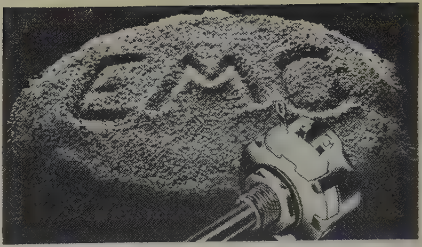
Light Nylon-Base Reinforced Plastic

A new nylon-base reinforced plastic features light weight and low thermal conductivity. Designated as "Tayloron" PN, the new material was specifically developed for rocket applications. It may be used for components where temperatures exceed 4000°F for short periods of time. A specific gravity of 1.20 and thermal conductivity at 200°F of .71 Btu in/ft^2/hr/°F are reported. Made from nylon fabric impregnated with a proprietary high temperature phenolic resin, Tayloron PN is claimed to have excellent physical, thermal, and erosion characteristics and good dielectric strength; to be highly machinable; and to exhibit high deflection under load. Tayloron PN is supplied in sheets, molded rod, plate, molded tube, rolled tube, molded shapes, and molding forms (sheets, rolls, and cut squares). Bulletin 8.9 available. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 119 on Reader Service Card

One-Part Epoxy Molding Compounds Cure in 15 Seconds

New single component epoxy molding compounds cure in as little as 15 seconds. A dry granular material, the new EMC 90 series is non-burning and offers a storage life of one year or longer at room temperatures. Developed for component encapsulation and other uses, the new series reportedly permits exceptionally high flow at low temperatures and pressures while providing excellent mold release and complete rigidity of parts upon ejection from the mold. Tested extensively in a variety of transfer and compression molding systems, the materials are said to have been used successfully in every application where mineral filled compounds are practical. Available in blue or black, mineral filled EMC 90 compounds are said to offer a versatile balance of physical, electrical, and chemical properties in four current formulations. Adhesive, Resin & Chemical Div., American-Marietta Co., 3400 13th Ave. Southwest, Seattle 4, Wash.



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Polyurethane Molding and Encapsulating Compound

A new electronic molding and encapsulating compound, polyurethane based, has been developed which operates from −65°F to 300°F (−53.9 to 149°C). Known as "Pro-Seal" 783, the material is stated to have outstanding physical and electrical properties. Shore hardness of 65 ±5, 600% elongation, and tensile strength of from 2500 to 3500 psi. Coast Pro-Seal & Mfg. Co., 2235 Beverly Blvd., Los Angeles 57, Calif.

Print No. Ins. 121 on Reader Service Card

Two Postformable Paper and Cloth Base Plastic Tubings

Two new grades of postformable Micarta tubing are now available. One grade (HY-370) is paper based; the second (HY-371) is cloth based. Both have sufficient thermo-plasticity to allow the tubing to soften when heated for five minutes in a thermal environment of 135 to 150°C. After it is softened, the tubing can then be given a permanent configuration. At room temperature and below, the postformed tubing reportedly displays the rigidity and other physical and electrical properties of standard thermoset

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A problem in rubber insulation?

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ENGINEERED COMPOUNDS:

Highly specialized electrical insulations. Resistant to extreme temperatures, fuels, oils, chemicals, weather and ozone. Designed to meet exacting physical specifications.

MATERIAL BASED ON:

Flurocarbons, hypalons, silicones, polyacrylics, neoprenes, butyls and general purpose rubbers.

PELMOR TECHNICIANS, serving a broad range of industries, are ready to supply you with mixed compounds, molded parts or solution coatings.

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"Black CRYSTOLON*" grain

...crystals that master lightning

Often referred to as "Black CRYSTOLON", Norton E 179 CRYSTOLON Electrical Grade silicon carbide grain is widely used in lightning arrestors — and in a steadily increasing variety of other nonlinear resistor applications in the electrical-electronics field.

These applications include protection of coils from overvoltage, protection of relay contacts, and general voltage stabilization . . . with voltage or surge control requirements ranging from thousands of amps to microamps . . . in resistors ranging in volume from thick arrestor blocks to paper-thin varistors.

To control its semiconduction properties, E 179 differs from regular CRYSTOLON silicon carbide grain by the addition of alumina. But the most important control of E 179 is constant control through each step of manufacture, from electric furnace to shipping drum. Accurate, duplicable grain impedance (resistivity) is assured by careful furnacing, grain processing, sizing, blending and surge testing.

In loose pack or ceramic bonded form, E 179 CRYSTOLON grain has the nonlinear current-voltage relation $I = AE^n$, where "A" and "n" are constants. For loose grain "n" may be as high as 10; for bonded grain it is usually between 3 and 7.

For surge tests, standard 280 ampere pulses are passed through a column of compressed E 179 CRYSTOLON grain, 1" diameter x 1" long. Voltage across the cell is measured in kilovolts per inch. E 179 CRYSTOLON grain is available in sizes of 60 to 240 mesh, covering a surge test range of 1.6 to 13.0 KV/inch.

For further facts, contact NORTON COMPANY, Refractories Division, 589 New Bond Street, Worcester, Mass.

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries.

NORTON
REFRACTORIES
Crystallizing ideas into products

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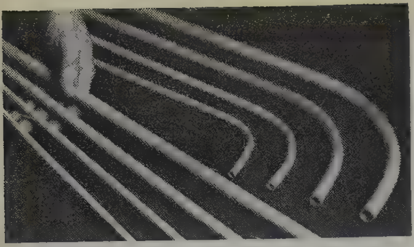


tubing and meets NEMA LE standards of chemical resistance and stability. Compressive strength of the tubing is 18,500 psi for the paper-based grade and 23,300 psi for the cloth-based grade; water absorption is 2.1% and 0.8%, respectively; and short-time dielectric strength is 700 vpm and 341 vpm. Internal diameters range from ⅛″ through 1″, wall thicknesses range from 1/32″ through 3/16″, and maximum length is 46″. Micarta Div., Westinghouse Electric Corp., Hampton, S.C.

Print No. Ins. 122 on Reader Service Card

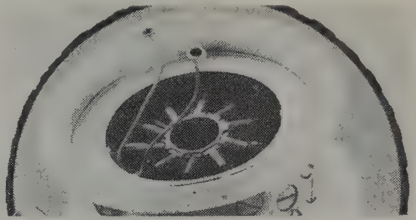
Tougher Acrylic Sheet

A new molecularly oriented acrylic sheet known as "Tuffak" is described as a rigid transparent material which can be stamped or punched, yet has good physical, chemical, and electrical properties. It is said to combine the excellent outdoor weathering properties of "Plexiglas" acrylic sheet with other special properties such as outstanding toughness and craze resistance. A notable increase in tensile elongation before rupturing is also claimed, along with a remarkable reduction in notch sensitivity. It is reported that the material can be nailed or punched without cracking if proper techniques are used. The new material is currently being offered as colorless sheet. Although the sheet is rigid, it is extremely flexible and can be readily cold formed. Price is 65 cents per sq ft in .050″ thickness. Technical data and samples available. Rohm & Haas Co., Plastics Sales Dept., Philadelphia 5, Pa.

Print No. Ins. 123 on Reader Service Card

Thin Wall Mica Paper Tubing Resists 1500°F Continuous, Radiation, Arcing

Rigid mica paper tubing with extremely thin walls has been developed for use as thermal and electrical insulation. Photo shows tubes in place around thermoelectric rods in the tiny new Snap III thermoelectric generator. Identified as "Isomica" 6T, tubing is said to be capable of continuous operation at 1500°F (816°C). Manufacturer states that electrical and physical properties of the tubing are unaffected by long exposure to such temperatures and that water absorption actually decreases from 7% to 1% after one week at 1500°F. Other features cited include high resistance to gamma radiation (A dosage of 10^3 megarads resulted in no noticeable change in dielectric strength or physical properties.) and arc resistance of such high magnitude that an actual value cannot be obtained with the present standard ASTM test method. Because it is resilient and does not embrittle at high temperatures, the tubing is also used for compressible bushings in heating elements for electric ranges. Coil forms, resistor and transformer cores, and space battery shields are other typical applications. The tubing is available in lengths up to 18″, with outer diameters up to 4″. Minimum inner diameter is ⅛″ and minimum wall thickness is 0.010-0.012″. Mica Insulator Div., Minnesota Mining and Manufacturing Co., Schenectady 1, N.Y.



Print No. Ins. 124 on Reader Service Card

Flexible Class B Polyester/Glass Varnished Tape and Fabric

A new flexible insulating tape and fabric may be used for class B layer and wrapper service. Features reported are high resistance to heat, tear, and creasing, and improved heat aging characteristics—attained without increase in cost. Recommended applications include coil wrapper, phase, ground barrier, lead and layer insulation, and cable tape. Original equipment manufacturers, electrical repair shops, and electric utilities may find this tape superior to conventional cotton-base insulations. The new material (5J39) is a fabric and tape composed of polyester warp fibers and glass fill fibers treated with an improved varnish. Nominal thicknesses are .007″, .010″, and .012″. Heat dissipation and heat resistance are said to be higher than in cotton-base insulations. The material reportedly conforms readily to irregular surfaces and has a smooth, slippery surface that permits tight wrap without excessive pull. Dielectric strength with ¼″ diameter electrode S/S for .012″ thickness is 1320 vpm as received, and 1250 vpm at 85°C. With ¼″ electrode S/T, dielectric strength is 1892 vpm. High heat resistance is shown by no cracking after 400 hrs at 124°C while bent over a ⅛″ mandrel. Westinghouse Electric Corp., Micarta Div., Trafford, Pa.

Print No. Ins. 125 on Reader Service Card

Flexible Epoxy Potting Compound

Flexible epoxy potting compound TC-459 reportedly is being used for connector potting and junction molding at missile launching sites. Cured TC-459 is glossy black and is said to offer mechanical strength and maximum moisture protection. It bonds well to rubber, neoprene, plastic (PVC), and nylon, but will release from surfaces properly prepared with TC-522 liquid mold release. Electrical properties reported (approximate values) include a dielectric constant of 3.2, dielectric strength of 1,500 vpm, insulation resistance of 10^{12} to 10^{14} ohms, and an 80 second arc resistance. Chemical Div., Electronic Production & Development Inc., 501 N. Prairie Ave., Hawthorne, Calif.

Print No. Ins. 126 on Reader Service Card

Tough but Flexible Epoxy Adhesive

"Miracle" NP 711, a new two-part thermosetting epoxy resin, reportedly provides an unusually strong yet flexible adhesive highly resistant to impact. The curing schedule varies depending on the nature of the materials being bonded, the thickness of the bond line, the temperature conditions,

(*Continued on page 68*)

STEVENS GLASS FABRICS

NOW! THIN-WRAP—HIGH DIELECTRIC STRENGTH

Stevens POLYGLAS* coating fabric provides voltage protection with *FEWER* and *THINNER LAYERS!* Thanks to Glass and Dacron® Polyester, Polyglas can be stretched to conform to intricate contours without opening or tearing, providing the smoothest base possible in woven insulation for cable overwrap. Dielectric properties actually increase after Polyglas coated tape is wound and stretched.

Polyglas is available as a base coating fabric in two-, three-, and four-mil thicknesses in lengths up to 1,500 yards per roll.

Stevens
INDUSTRIAL
GLASS
FABRICS

Stevens rigid testing and production control assure uniformly high standards and close tolerances.

Write or phone for suppliers of Polyglas coated fabric or tapes.

*64% Glass/36% Dacron® Polyester

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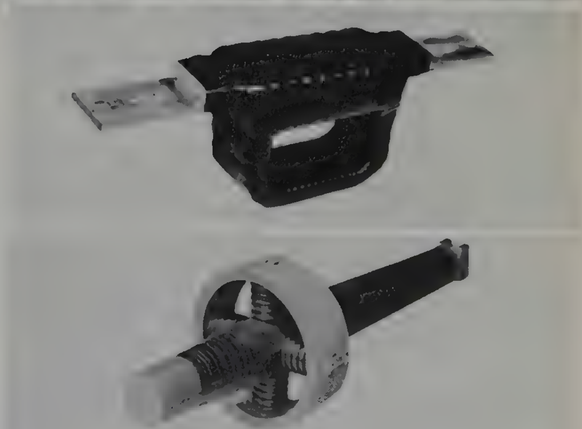


Current Transformer (top), Power Distribution Bus (bottom) illustrating two of the many taping operations for Teraglas† made with Stevens new Polyglas fabric. †T.M. Natvar Corp.

J. P. Stevens & Co., Inc.

INDUSTRIAL GLASS FABRICS DEPARTMENT
Broadway at 41st Street, New York 36, New York. OXford 5-1000
2838 East Pico Blvd., Los Angeles, California. ANgelus 8-2755

Fine Fabrics Made in America Since 1813

SILICONE NEWS from Dow Corning

For Faster Processing

New ready-to-use silicone rubber insulates, bonds; saves time, money

Silastic® RTV 891, the new squeeze-from-a-tube silicone rubber can save time and money for you. It has already helped a leading motor producer make a five-fold cut in the time required to insulate form-wound motor coil connections. The technique is simple: silicone rubber caps — molded of Silastic and available from rubber fabricators — are filled with Silastic RTV 891 and slipped over the brazed connections. Result: five connections can be insulated in the time formerly required for one!

Silastic RTV 891 cures to a rubbery solid without catalyst, without heat, without sagging or slumping. Once cured, it bonds securely to both leads and Silastic caps. Each connection is completely sealed against moisture, abrasives, chemicals; will withstand temperatures from —75 to 260 C (—100 to 500 F).

Ease of application, electrical properties, moisture resistance and heat stability make this new Dow Corning product a valuable tool for sealing or bonding in many electrical and electronic applications. Some of the many uses include: bonding components to printed circuits; insulating and sealing wire and cable connectors; sealing conduit and terminal boxes; sealing compression connectors; bonding components in place; sealing enclosures. For Silastic RTV 891 or for more information on this product, contact the Dow Corning Authorized Distributor nearest you.

Print Ins. 27A on Reader Service Card

TYPICAL ELECTRICAL PROPERTIES
OF SILASTIC RTV 891

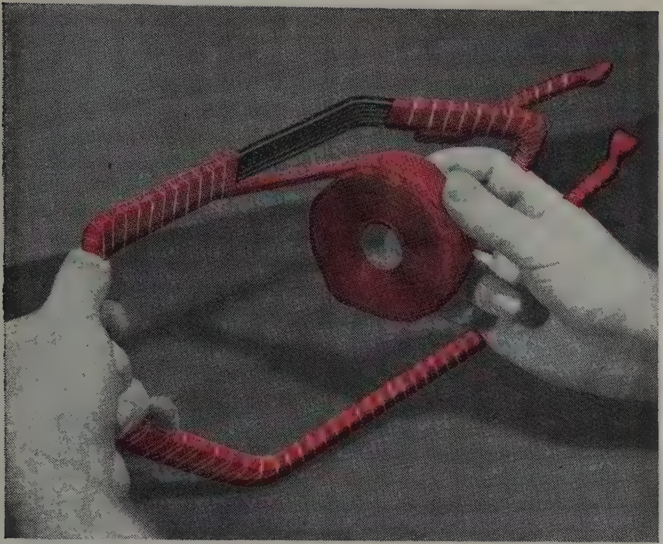
	After Curing at 77 F And 50% Relative Humidity	
	One Week	*Four Weeks*
Electric Strength, volts per mil (65-mil thickness, ¼″ ASTM electrodes in oil, rapid rise) ASTM D 149	300	350
Volume Resistivity* ohm-centimeters (ASTM D 257)	2.5×10^{13}	1×10^{15}
Dielectric Constant* (ASTM D 150) *Per Second*:		
at 60 cycles	3.4	3.4
at 1000 cycles	3.4	3.4
at 0.1 megacycles	3.4	3.4
Dissipation Factor* (ASTM D 150) *Per Second*:		
60 cycles	0.002	0.0014
1000 cycles	0.001	0.001
0.1 megacycles	0.001	0.001

* Measured using potted, modified Cardwell ER-50-FS fixed capacitors as electrodes.

first in silicones

Dow Corning

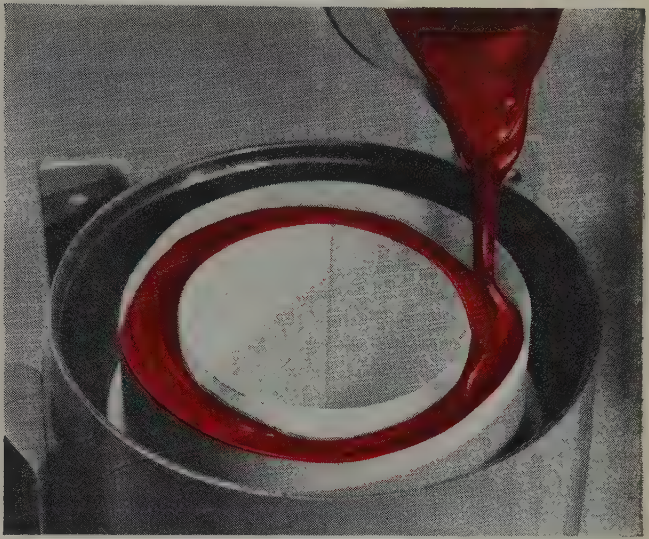
–specify these silicones



Tape cuts costs 50 to 60%

Triangular Guideline tape, made with Silastic® silicone rubber, gives you the superior protection of a silicone insulation system while cutting application costs from 50 to 60% compared with conventional taped systems. A single wrap of Guideline tape is all that's needed to produce the entire primary insulation wall thickness. The tape bonds to itself . . . beveled edges overlap to produce a void-free insulation structure . . . conspicuous center line makes it easy to achieve a precise half-lap wrap of uniform thickness. Guideline tape, made of Silastic, produces a homogeneous, resilient insulation system that resists heat, cold, moisture, abrasives, many chemicals and corrosive atmospheres.

Print Ins. 27B on Reader Service Card



Easy-to-use encapsulant

Encapsulating random wound motors against heat, cold, moisture, and abrasives is now a simple matter with Silastic RTV, the Dow Corning silicone rubber that cures at room temperature. It pours smoothly into place; bonds tightly to primed surfaces and quickly vulcanizes into a void-free, homogeneous rubber jacket. When cured, it expands and contracts with windings and laminations . . . will not hairline crack. The process for application is simple: (1) paint end turns and lamination surfaces with primer; (2) put simple forms in place; (3) pour catalyzed Silastic RTV over coil end turns. Handy kits containing everything you need are available from the Authorized Distributor in your area.

Print Ins. 27C on Reader Service Card

The Dow Corning Authorized Distributor nearest you is your best source for slot liners, magnet wire, top sticks, phase insulation, coil dividers, tape, tying cord, filling materials, dipping varnish, adhesives, compounds, Silastic RTV and other performance-engineered silicone materials.

first in silicones Dow Corning
SILICONE INSULATION
AUTHORIZED DISTRIBUTOR

Allied Electrical Insulation, Inc.
Rochester, N. Y.

*Brownell Electrical Insulation
New York 11, N. Y.

Butts Electric Supply Company
Oklahoma City, Oklahoma

*C. D. LaMoree Company
Los Angeles 15, California

*C. E. Riggs, Inc.
Portland, Oregon

*Earl B. Beach Company
Pittsburgh 21, Pennsylvania

E & H Electric Supply Co.
Louisville 3, Kentucky

Electrical Insulation Suppliers, Inc.
Atlanta, Georgia

Electrical Maintenance Equipment Co.
Philadelphia 23, Pennsylvania

*Insulation and Wires Incorporated
St. Paul 1, Minnesota

*Insulation Manufacturers Corporation
Chicago 6, Illinois

J. R. Christensen Agency
Salt Lake City 11, Utah

McNaughton-McKay
Detroit 4, Michigan

National Electric Coil Company
Columbus 16, Ohio

*Prehler Electrical Insulation Co.
Chicago 39, Illinois

Robert McKeown Company, Inc.
Livingston, New Jersey

*Summers Electric Company
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The Electric Motor Supply Co.
Baltimore 2, Maryland

The Huse-Liberty Mica Company
Peabody, Massachusetts

*Tri-State Supply Corporation
Los Angeles 13, California

White Supply Company
St. Louis 10, Missouri

** These Distributors also have offices in other cities*

For complete data on any of these silicone products,
write Dow Corning Corporation, Dept. 6522, Midland, Michigan.

BRAND
REX

TURBOSIL®
and
TURBO 117®
silicone
and
silicone
rubber
sleevings

Developed especially for both high and low temperature resistance, Brand-Rex Class H sleevings are available in sizes #24 to 1" I.D. and in 5 grades. Both Turbosil®, a silicone varnished glass, and Turbo® 117, a silicone rubber coated glass, meet performance requirements of MIL-I-3190.

For complete information and samples, or if you wish technical assistance in selecting the right insulation for your application, write or call

BRAND
REX
DIVISION OF
American ENKA Corporation
SUDBURY ROAD, CONCORD, MASSACHUSETTS
TELEPHONE: EMERSON 9-9630

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etc., but generally speaking the assembly may be moved about in 1½ to 2 hrs, and complete cure will occur in 24 to 48 hrs at room temperature. The addition of heat (from 175 to 250°F) shortens curing time. Working or pot life is said to range from 45 minutes to 1½ hrs, depending on the mass of material that is mixed. Temperature range is from —40° to 250°F (—40° to 121°C). The new product is also said to be non-flammable, practically non-toxic, and safe from hazards of vapor exposure. Miracle Adhesives Corp., Bellmore, L.I., N.Y.

Print No. Ins. 127 on Reader Service Card

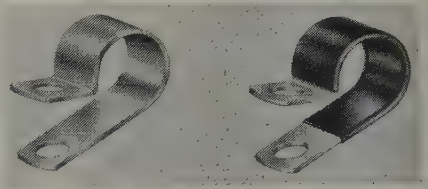
Rubber-Like Compounds Cure Without Heat or Pressure

A new family of rubber materials, unlike other rubber or synthetic rubber compounds, does not require heat or pressure. They consist of two liquids which are simply mixed together. The mixture cures at room temperature to form an extremely strong, tough, and highly resilient product. They are non-shrinking and thick sections can be poured or cast at one time. At present only two materials are available: Devcon R-A, a putty-like substance that can be applied to a vertical surface without running or sagging, and Devcon R-B, a liquid type that can be poured. Both are said to have high tensile, tear, and abrasion resistance, and also good adhesion to iron, steel, aluminum, and other metals as well as to wood, natural and synthetic rubber, canvas, glass, some plastics, and many other materials. They can be applied directly to the surface and allowed to cure in place. Once cured, they reportedly have considerable resiliency and little or no tendency to cold flow or change shape under pressure. Good low temperature flexibility, light weight, and very good oil and chemical resistance are other properties reported for the waterproof materials. They are 100% solids and do not contain any solvents or diluents. Both materials have many uses and should be of great interest to automotive and aircraft manufacturers, radio and electronic manufacturers, and many other industries. Savings in time, money, and labor are expected. Trial kit costs $6.70 and contains 1 lb of Devcon R-A, 1 lb of Devcon R-B, curing agent for each material, plus complete instructions and bulletin. Devcon Corp., Danvers, Mass.

Print No. Ins. 128 on Reader Service Card

Neoprene Coated Cable Clamp With Strain Relief Feature

New style of cable clamp is made of neoprene coated aluminum. Easily assembled, it is said to offer advantages of low cost, freedom from rust, and time-saving assembly. The type NE clamp also offers insulating and strain relief qualities. The flame-resistant neoprene cushion, because of its high friction coefficient, reportedly holds the cord or tubing with a positive non-sliding grip that prevents any strain on connections. Cushioning action minimizes cutting and scraping of cord insulation. The neoprene is oil-resistant and will maintain its natural qualities over a wide temperature range. Available for ⅛" to 2" cable in 1/16" increments. Richco Plastic Co., Dept. IN-2, 3722 West North Ave., Chicago 47.



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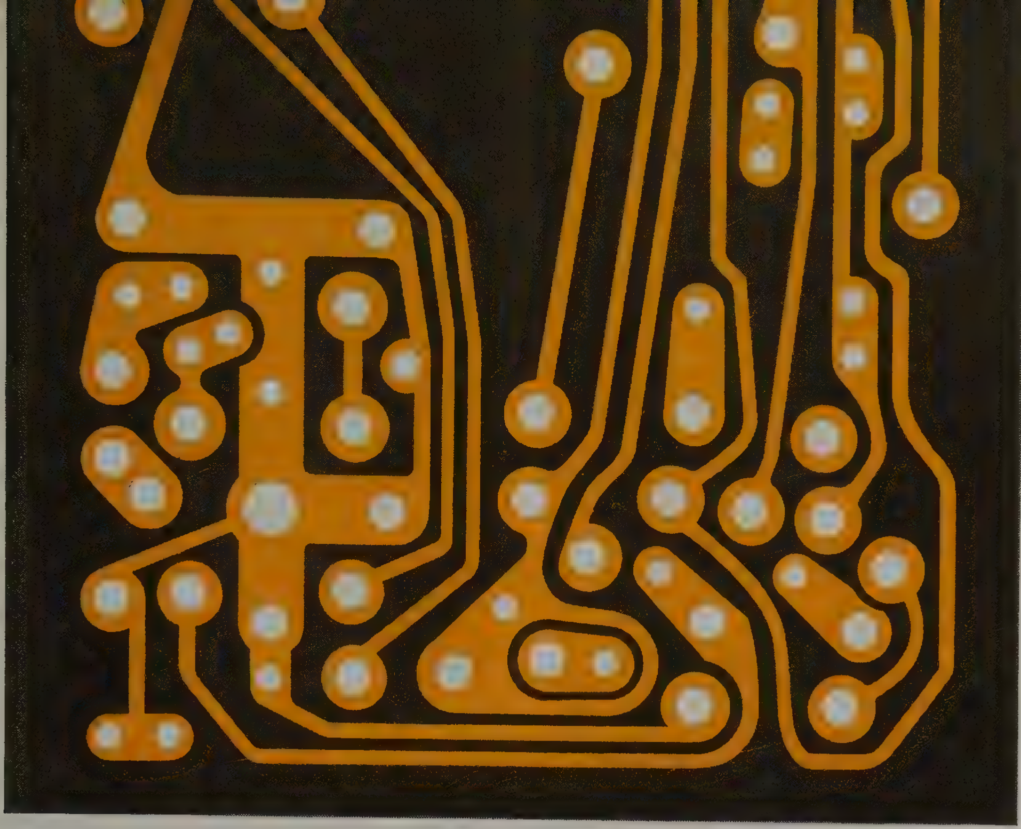
Steatite Tubes for Resistor Forms

New round steatite ceramic tubes are especially designed for use as forms for vitreous enamel resistors. A wide range of tube lengths with outside diameters from ⅛" to ¾" can be supplied. Samples available. Ceramic Products, Centralab, The Electronics Division of Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

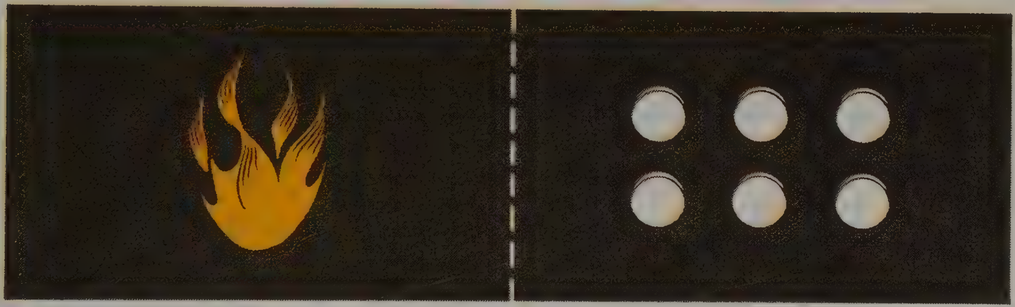
Print No. Ins. 130 on Reader Service Card

Multiple Polyethylene Tubing in Vinyl Outer Sheath

New "Instrupack" consists of bundles of polyethylene tubes in a vinyl sheath, in lengths up to 1,000 ft. The tubes are manufactured from virgin polyethylene of high molecular weight and low melt index (0.2-0.4). Material is said to have excellent aging



Now...phenolic laminates with both flame retardance and cold punchability



NEW RESINOX 495 VARNISH makes it possible for the first time to produce phenolic laminates with both flame retardance and excellent cold punching characteristics. Paper-based laminates impregnated with Resinox 495 meet the electrical, physical, and mechanical requirements of NEMA standards for XXP and XXXPC copper-clad laminates—yet they cost less than other laminates with equivalent properties.

Resinox 495 Laminates are especially recommended for printed circuits used for commercial radio and TV applications, and as copper-clad laminates for electronic computers and military applications, or for any other application where flame retardant laminates are desirable or mandatory. Use coupon below for additional data and list of leading laminators now supplying 495 laminates.

MONSANTO INITIATOR IN **PLASTICS**

Monsanto ®

MONSANTO CHEMICAL COMPANY, Plastics Division
Room 836, Springfield 2, Mass.

Please send me technical data bulletin on Resinox 495, also list of laminators supplying 495 laminates.

Name____________________ Title________________

Company____________________________________

Address____________________________________

City____________________ Zone____ State________

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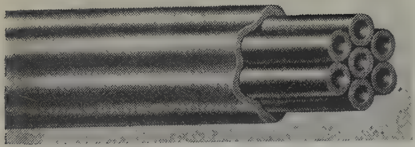


properties, good low temperature toughness, and superior resistance to environmental conditions. Tubes are available in colors. The outer sheath is virgin PVC (vinyl chloride). It has excellent resistance to many conditions, and is most commonly furnished in black. Pyramid Plastics Inc., 554 W. Polk St., Chicago 7.

Print No. Ins. 131 on Reader Service Card

RF Shielding Assemblies

A new ready-to-install honeycomb structure, securely mounted in a rigid frame with an integral RF gasket, reportedly provides excellent radiated RF attenuation while allowing cooling air to pass through the structure. The "Teckcell" assembly was developed for efficient shielding in electronic packaging where forced air cooling is a problem. Another new shielding assembly is "Teckstik," which combines an RF seal with a fluid gasket, and simplifies installation and cuts time and labor with a pressure-sensitive adhesive on the fluid gasket. The adhesive is so effective, it is stated, that in tests the gasketing material was shown to tear before the adhesive would give way. Technical Wire Products Inc., 129 Dermody St., Cranford, N.J.

Print No. Ins. 132 on Reader Service Card

Prepolymer for Electronic Potting and Encapsulation

A new 100% resin isocyanate prepolymer that reportedly cures rapidly without excessive air voids or shrinkage is expected to have wide use in the potting and encapsulation of electronic components because of its high dielectric strength and high power factor. It may be used in polyurethane foam formulations, as an adhesive, or diluted with xylol for coating purposes. Other properties claimed include excellent salt water spray resistance, unusual low temperature and weather resistance, and resistance to acids, water, solvents, and most chemicals. Isochem Resins Co., 221 Oak St., Providence 9, R.I.

Print No. Ins. 133 on Reader Service Card

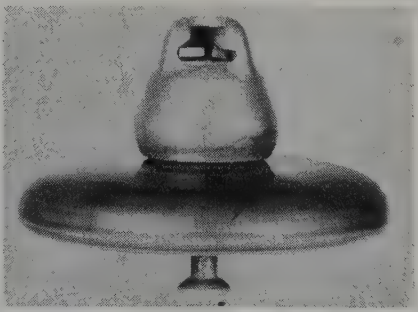
Liquid Fluorocarbon Slip and Anti-Stick Molding Agent

A reinforced fluorocarbon slip and anti-stick agent which provides a clean, low-friction, dry surface to end mold sticking problems and to speed mold release is now available in liquid form. Originally introduced in aerosol spray cans, "Rulon" liquid comes in pint and quart containers, ready for application by brush, spray, dipping, wiping, or soaking. The material is said to be an excellent preassembly coating to facilitate product assembly and to provide a slick surface for wood, metal, plastics, and many other materials. Coefficients of friction as low as .07 are reported. Stick-slip at low speeds is also eliminated. Chemically inert, insoluble, and thermally stable to 500°F, the fast-acting liquid is also stated to be an ideal release agent in molding plastics, rubber, synthetic rubbers, and high polymers. It reportedly dries instantly, without leaving a gummy or oily film . . . cuts rejects by minimizing spalling, fish eyes, and part marking on fast cycles. Dixon Corp., Bristol, R.I.

Print No. Ins. 134 on Reader Service Card

Lighter 9" Suspension Insulator Comparable to 10" Units

A new compact 9″ suspension insulator has a combined M&E strength rating of 14,000 lbs. The new suspension, called "Hi-F" (for high-efficiency) combines the cap-head-and-pin design of a standard 6″ dead-end insulator with the shell design of a standard 10″ suspension. Since both the cap and the shell are 1″ smaller in diameter, the new suspension has the same leakage distance as the standard 10″ insulator. Unit spacing is the same so string flashover characteristics, e.g., wet, dry and impulse, are the same as existing NEMA standards for 15,000 lb, 10″ suspensions. It is recommended for normal duty transmission lines and reportedly provides an adequate safety factor for any suspension use on working loads up to 7,000 lbs. Weighing about 1/3 less than the standard 10″ unit, the new suspension is available in both ball-socket and clevis type units for 5¾″ spacing and ball-socket units for 5″ spacing. Impact strength rating is 55 in-lbs, identical with NEMA standard 10″ units. It is physically interchangeable with NEMA standard 15,000 and 25,000 lb suspension insulators. Lapp Insulator Co. Inc., Insulator Div., Le Roy, N.Y.



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Improved Miniature High Temperature Coaxial Cables to Mil-C-17C

New versions of miniature high temperature coaxial cables included in Mil-C-17C have made possible seven new constructions. RG-178B/U, RG-179B/U, and RG-180B/U are now available with "Teflon" FEB jackets which permit higher operating temperatures than their previous number types. RG-187A/U, RG-188A/U, RG-195A/U and RG-196A/U are now available with annealed center conductors (8% minimum elongation) which permit greater tensile loads to be applied. Times Wire & Cable, Division of The International Silver Co., Wallingford, Conn.

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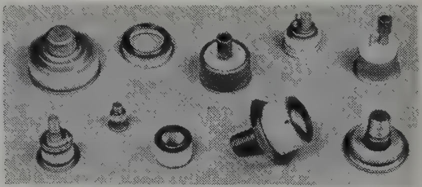
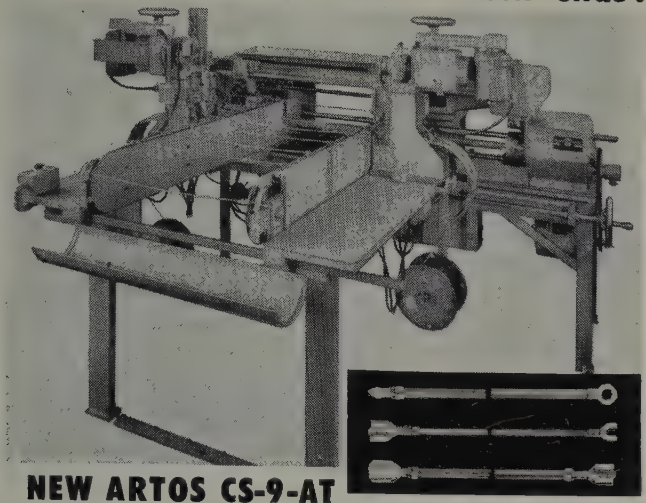
Ceramic-to-Metal Housings for Semiconductor Rectifiers

High temperature ceramic-to-metal housings suitable for use in packaging power and controlled rectifiers are said to be capable of withstanding temperatures to 1700°F (927°C). The ADVAC rectifier housings reportedly offer high metal strength and excellent dielectric properties combined with a positive hermetic seal. Sheer strength in the order of 15,000 psi, excellent thermal shock resistance at temperatures of 1000°F (538°C), coupled with high thermal conductivity are characteristics reported for



Produce 4,000 finished wire leads per hour . . . with terminals at both ends!



NEW ARTOS CS-9-AT AUTOMATIC MACHINE

1. measures any type of wire.
2. cuts off wire to length.
3. strips one or both ends.
4. attaches terminals at both ends.
5. provides stations for other work.

ARTOS CS-9-AT CAPACITY

Wire Sizes: 20-gauge to 4-gauge.
Cutting Lengths: 6″ min. to 90″ max.
Stripping Lengths: 3/16″ to 1½″.
Output: 6″-45″ lengths—4,000 per hr.
45″-90″ lengths—2,000 per hr.

Other Artos machines handle 30 to 000 gauge wire; cut lengths from 2 in. to 45 ft.; strip insulation 3/16 to 10½ in.

WRITE FOR BULLETIN 358

Agents throughout the world

ARTOS ENGINEERING CO.
2763 S. 28th Street • Milwaukee 46, Wisconsin
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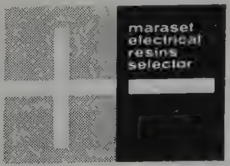
New! Maraset FLEXIBLE CLASS H Epoxy Resins

protect against thermal shock and mechanical shock —permanently retain flexibility even at low temperatures, so that low pressure is extended on encapsulated or impregnated electrical and electronic apparatus including coils, motor stators, transformers, capacitors.

Single-component **Maraset 138** and two-component **Maraset 143** are liquid epoxies with low viscosity and negligible exotherm—suitable for large mass casting. Single-component **Maraset 162** is a non-sag, thixotropic paste for dip-coating applications.

Federal specifications MIL-I-16923C and MIL-T-27A are met by all three resin systems. All three provide uniformity, toughness, high strength—can be operated under continuous Class H high-temperature conditions.

FREE—request your copy of the newly revised Maraset Electrical Resins Selector, or technical bulletins on these resins.



Marblette

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Quality Resins—Since 1929

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10th ANNIVERSARY OF INSULSTRUC®

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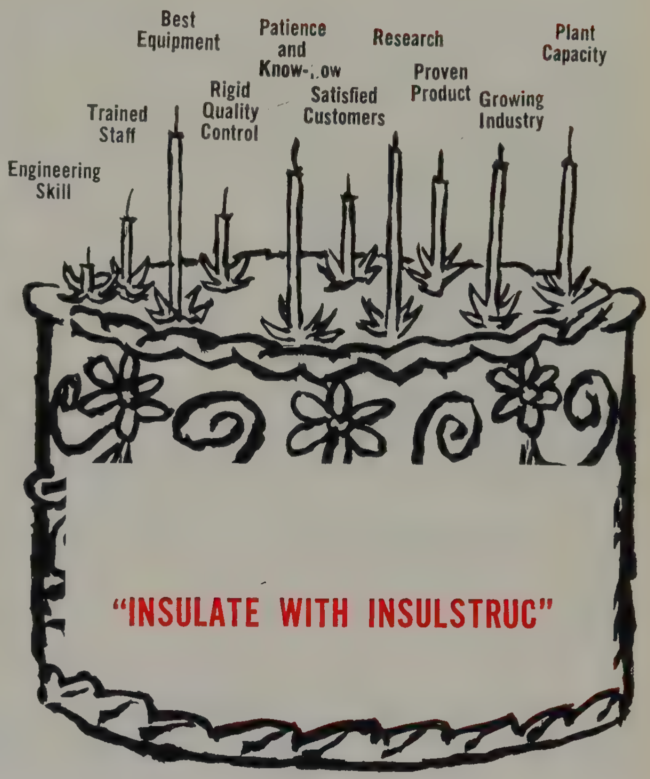

Our thanks to our customers, who have made our growth possible. Our firm makes "Insulstruc" glass fiber reinforced polyester laminated sheets and premix molded parts for electrical/electronic insulating and structural purposes. We'd welcome the opportunity of telling you how our products can fit into your applications. We sincerely wish to be of service. A catalog will be sent if you fill out the reader service card.

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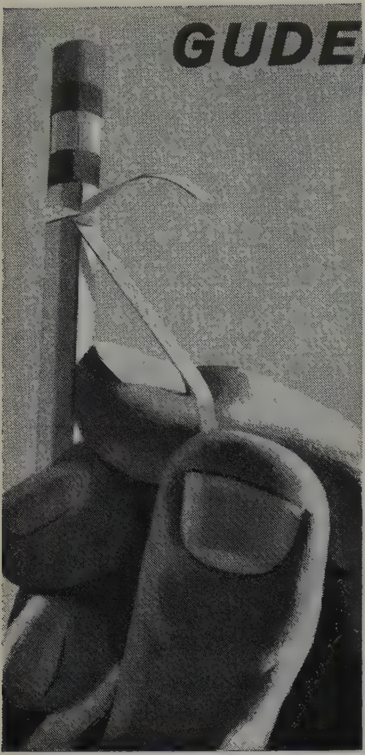


GUDELACE®...

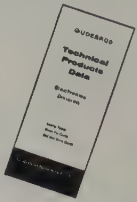
the lacing tape with a NON-SKID tread

You can't see it, but it's there! Gudelace is built to grip—Gudebrod fills flat braided nylon with just the right amount of wax to produce a non-skid surface. Gudelace construction means no slips—so no tight pulls to cause strangulation and cold flow.

But Gudelace is soft and flat—stress is distributed evenly over the full width of the tape. No worry about cut thru or harshness to injure insulation . . . or fingers.

Specify Gudelace for *real* economy—faster lacing with fewer rejects.

Write for free Data Book.
It shows how Gudelace and other Gudebrod lacing materials fit your requirements.



GUDEBROD BROS. SILK CO., INC.

ELECTRONICS DIVISION
225 West 34th Street
New York 1, New York

EXECUTIVE OFFICES
12 South 12th Street
Philadelphia 7, Pa.

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SOLVE WIRE-STRIPPING PROBLEMS

with NEW Wassco® GLO-MELT WIRE STRIPPER

FAST, FLEXIBLE AND ECONOMICAL REMOVAL OF ALL PLASTIC INSULATED WIRE

Wire stripping problems fade away with a Wassco Glo-Melt wire stripper. This new tool is a cool, light, highly flexible hand piece with a single, heavy duty Nichrome cutting element for long life. It can be used for on the job applications or for bench work with optional foot control. The Wassco Glo-Melt wire stripper gives you a cleaner, faster job . . . is perfect for hard-to-get-at places . . . strips insulation including Teflon, Nylon and fiberglass up to No. 8 insulated wire with a simple *twist of the wrist.* No sharpening or adjusting,—just plug in and you are ready instantly to do a perfect stripping job with speed and ease. Inquire about our 10 day free trial.

• CUTS REJECTIONS

• INCREASES JOB EFFICIENCY

206-B

Wassco GLO-MELT DIVISION
AMERICAN ELECTRICAL HEATER COMPANY
DETROIT 2, MICHIGAN

American Beauty Electric Irons Since 1894

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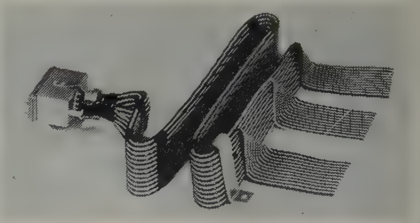
the vacuum seal, leak tested 1 x 10^{9}-cc/sec. The housings consist of metallized alumina ceramic brazed to metal hardware. Advanced Vacuum Products Inc., 430 Fairfield Ave., Stamford, Conn.

Print No. Ins. 137 on Reader Service Card

Flat Extensible Cable

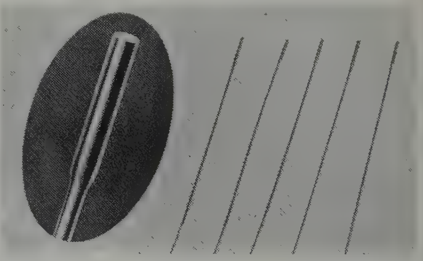
New extensible cable based on flat "Spectra-Strip" ribbon is multi-conductor, multi-colored, and can be supplied complete with potted terminations. Any number of conductors, No. 10 AWG to No. 30 AWG, including coax with PVC jacket may be provided. Engineering charts available. Spectra-Strip Wire & Cable Corp., P.O. Box 415, Garden Grove, Calif.



Print No. Ins. 138 on Reader Service Card

One-Piece Lead Wires Eliminate Welded Joint

One-piece, necked-down lead wires for glass sealing applications eliminate the welded joint which is said to be the weak point in conventional two-piece leads. New type leads are offered in most glass sealing alloys. Approximately 3″ long, they are available in diameters from .020″ to .050″, which may be necked down by as much as 50% of the original wire size. Send blueprints or sketches indicating requirements to receive details, price information, etc. Art Wire and Stamping Co., 227 High St., Newark 2, N.J.



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'Teflon' Terminal for Encapsulated Components

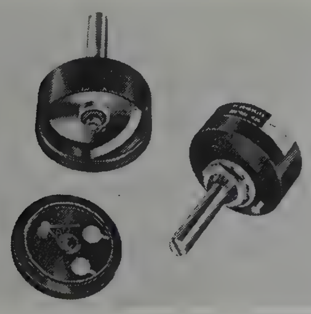
A new design of "Press-Fit" Teflon terminals permits their use in compo-

nents, or component assemblies, of the encapsulated or potted types. The FT-MM-3SL Feedthru reportedly provides a positive encapsulation seal to the potting compound by means of a fluted section on the metal stud immediately below the Teflon body. The FT-MM-3SL has a .093″ maximum diameter. Mounting body is .075″ D, over-all length is .510″. External stud is of the usual slotted design, and internal stud is .030″ D. The stud is brass, with a solder finish. Sealectro Corp., 610 Fayette Ave., Mamaroneck, N.Y.

Print No. Ins. 140 on Reader Service Card

Molded Plastic Potentiometer

A new molded conductive plastic potentiometer is said to achieve infinite resolution, characterized by no loss of accuracy or increase in noise even with high rotational speeds over long periods of operation—making it ideal for servo and instrumentation applications. Conductive plastic potentiometers (New England Instrument Co., Waltham, Mass.) also feature exceptional resistance to humidity, superior electrical and physical properties, low moisture absorption and ability to withstand extremes of temperature, vibration, and shock.



The solid resistance element, insulating base and silver terminal leads were molded in one operation into a single unit. The basic material used is "Dapon" (diallyl phthalate).

PROFIT PICTURE

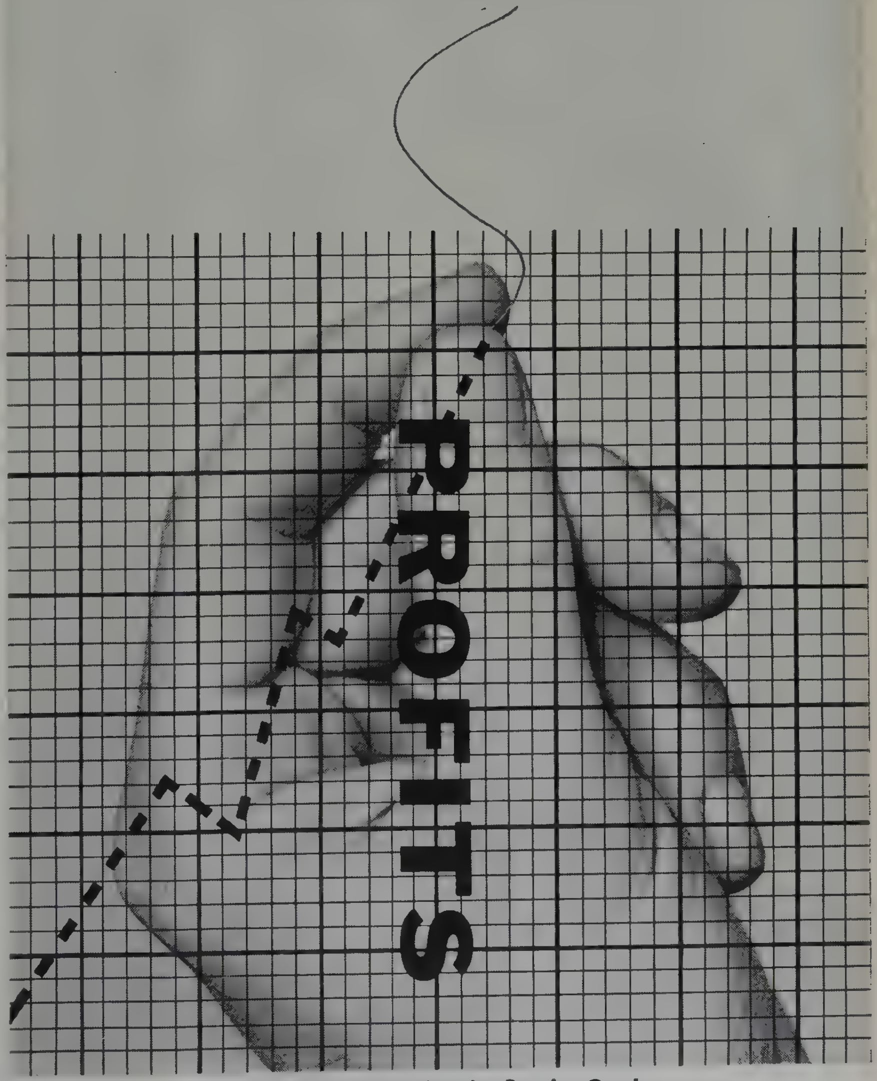
A few centimeters of wire. It was saved by using Patapar® Brand Insulating Parchment on an automatic coil winding machine. Big saving? Multiply it by the number of coils *you* make.

The rigidity and superior machinability of Patapar Brand Parchment makes a smaller coil cross section possible . . . therefore, less wire. Its etched surface grips wires more firmly than other Class A materials without wearing through. And the minimum point of voltage breakdown is superior to other materials.

Send For Free Sample Package of Patapar Brand Insulating Parchment.

PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
NEW YORK, N.Y. CHICAGO, ILL. SUNNYVALE, CALIF.

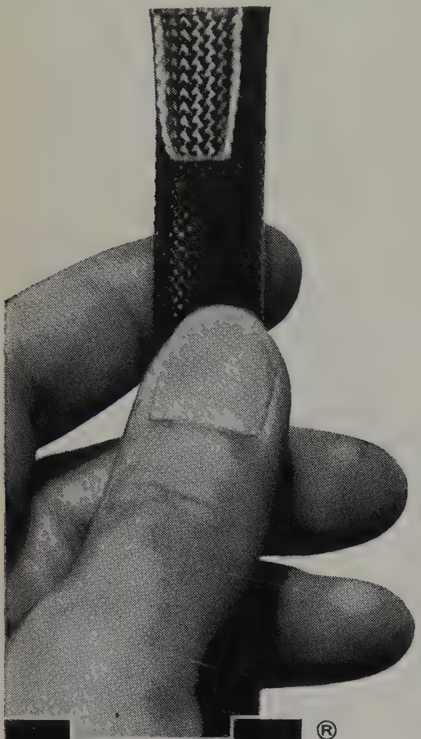
Patapar®
INSULATING PARCHMENT



Print Ins. 35 on Reader Service Card

Test It!

It's silicone rubber on braided fiberglass



HYGRADE®

SR-398

A superior silicone rubber compound over fiberglass produces a tough and nearly glass-smooth surface for higher abrasion and cut-through resistance. It is tested to MIL-T-5438 specs. Tensile strength, 1000-1200 psi, yet it expands to slip over terminals, connections. High dielectric strength (8000v) maintained even after continuous use at rated 210°C. Write, phone, or wire for test samples.

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High Temperature Wire and Cable

NORRISTOWN, PENNSYLVANIA

Print Ins. 36 on Reader Service Card

New Instruments and Equipment

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Non-Destructive Thickness Gage for Insulating Coatings on Aluminum

A new, non-destructive testing device for accurate gaging of non-conductive coatings on aluminum and its alloys is called type EC Permascope. A compact, portable unit measuring 9″ x 6½″ x 6½″, it can be used wherever there is a 110 v a-c outlet. The unit operates on the well known eddy current test principle, but is said to allow compensation for conductivity variations of the base metal which would otherwise produce erroneous readings. Equipped with two direct-reading scales, the standard model has thickness measurement ranges of 0-0.001″ and 0-0.005″. A modified version is available with a thickness measurement range of either 0-0.001″ or 0-0.005″ plus a conductivity measurement of 16-110% IACS. Slip-on adapters can be provided for measurements on cylindrical surfaces and narrow strips. Twin City Testing Corp., 533 South Niagara St., Tonawanda, N.Y.

Print No. Ins. 201 on Reader Service Card

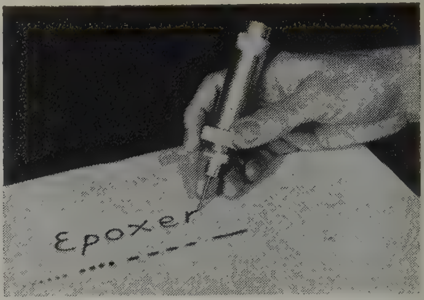
Improve Control to ±¼°F in Temperature Chambers

The 1060 series temperature chambers, formerly with ±½°F control, are now being built and specified at ±¼°F control accuracy. The new chambers use the same d'Arsenval pendulum proportioning control system which has a theoretical resolution limit of zero. Delta Design Inc., 3163 Adams Ave., San Diego 16, Calif.

Print No. Ins. 202 on Reader Service Card

Hand Dispenser of Liquid Epoxies

A new hand dispenser for epoxy adhesives and potting compounds, the "Epoxer," will dispense filled or unfilled materials with viscosities from water to heavy pastes. The user has finger tip control of the amount dispensed, with positive cut-off, varying from minute dots to a continuous bead. Once the replaceable cartridge is filled with catalyzed material and the unit pressurized, it is self contained. There are no attached air lines. Replaceable cartridges may be filled with catalyzed materials and stored under refrigeration until required for dispensing. Price with nozzle for air pressurizing and spare needle of different size is $48. Kenics Corp., Box 27, Greenwood Sta., Wakefield, Mass.



Print No. Ins. 203 on Reader Service Card

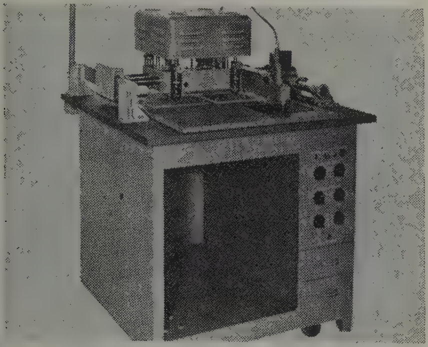
Unit Measures Dissipation Factor, Wide Range of Capacitance

Wide selection of high voltage capacitance bridges, featuring direct reading and a built-in performance check, are available in mobile or stationary consoles at up to 500 kv or any higher voltage which may be desired. They feature an accuracy of capacitance measurement of 0.2% and dissipation factor measurement of 0.01%. The new line is designed to measure capacitance, dielectric losses, and dissipation factor of insulation and insulated apparatus such as bushings, power cable, transformers, generators, motors, and switchgear. The characteristics may be measured while insulation is stressed at operating voltage. Both capacitance and dissipation factor can be read directly without calculations. A transistorized null detector is included to reduce maintenance and to prolong battery life. High Voltage Specialty Transformer Section, General Electric Co., Holyoke, Mass.

Print No. Ins. 204 on Reader Service Card

Circuit Board Drilling Machine

New Quad-Drill is said to be an economical, high precision circuit board drilling machine which lends itself to both long and short run production. When stack drilling on four spindles, precision clean-wall and burr-free holes may be produced at the rate of 25,000/hr. Hole location reportedly is maintained within .001″ of true template position. This unit is a free-moving coordinate axis machine which permits two directional positioning of a central drill head over desired locations. The drill stroke speed is adjustable from 0 to 35″ per minute and drill speed from 0 to 21,000 rpm. Excellon Industries, 5002 Crenshaw Blvd., Los Angeles, Calif.



Print No. Ins 205 on Reader Service Card

Non-Destructive Hipot Testers

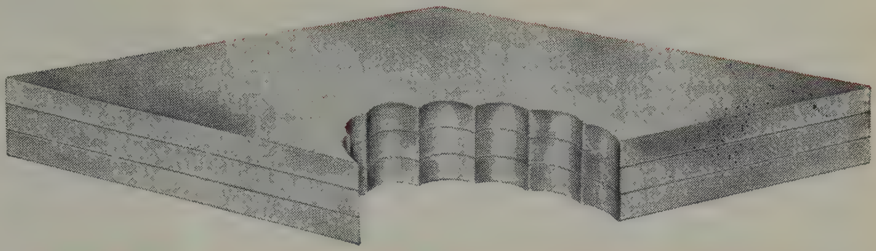
A new line of a-c Hipot testers is designed for non-destructive testing of relays, wiring, assemblies, switches, small transformers, printed circuit boards, etc. Twenty-two models are available with output voltages from 0-1500 to 0-10 kv a-c—all suitable for testing to ASTM, NEMA, and UL specifications. All models are furnished with input cord, high voltage output leads with clips, continuously variable voltage control, breakdown indicator, and adjustable leakage indicator. Output voltage is indicated on a 4½″ meter for easy reading. Models with output current limited to 5 Ma and models with audible alarms are included. Davenport Mfg. Div., Duncan Electric Co. Inc., Dept. IN2, 2530 N. Elston Ave., Chicago 47.

Print No. Ins. 206 on Reader Service Card

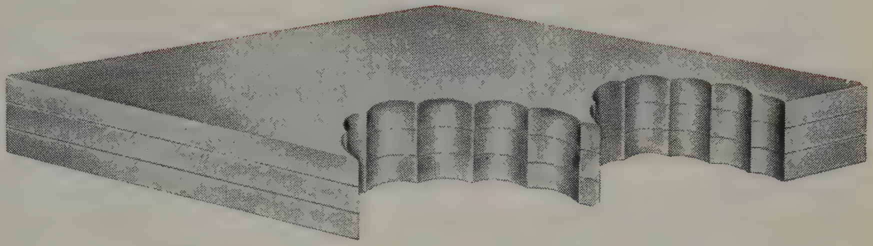
Electronic Recorder Shows Tension Changes of Moving Wires, Cables, and Tape

A new electronic tension recorder records tension and its changes dur-

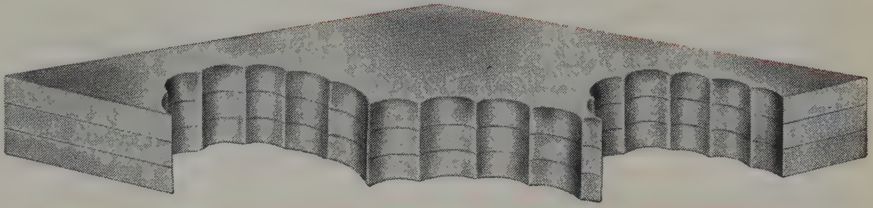
DAY AFTER DAY AFTER DAY



MORE AND MORE CUSTOMERS



ARE EATING IT UP . . .



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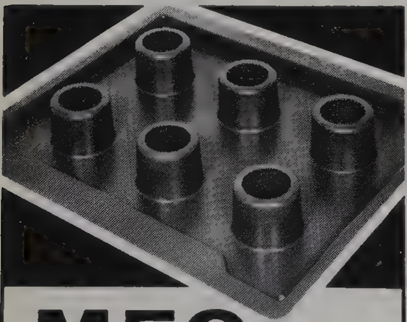

MFG
combines these features:

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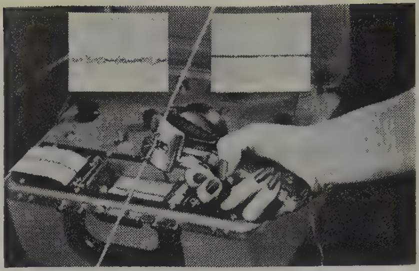
- low power factor
- high arc resistance
- formability in complex shapes

Add to these the excellent heat resistance, low moisture absorption and excellent moldability of MFG reinforced plastic—and you get better performance at significantly low cost!

Molded Fiber Glass Company

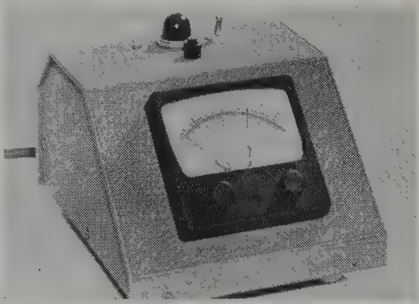
4307 Benefit Avenue, Ashtabula, Ohio



ing all preparatory operations of wires, cables, tapes, yarns, and cordage. It shows quickly changing tensions electrically during the preparation of wires and cables at full speed. Steps can then be taken to engineer and standardize best tensions. Tension is sensed by a hand-held electric tension transducer. Tensitron Inc., P.O. Box 185, Harvard, Mass.
Print No. Ins. 207 on Reader Service Card

Temperature Monitor

A temperature fail-safe unit limits the excursion of temperature between two pre-set limits. When the limit of temperature is reached, the temperature chamber in which the devices are being tested is automatically turned off and cannot be turned on without a manual re-set. If a heat generating device such as a motor or electronic capsule is being tested, and an over heat condition is reached, the device being tested can be turned off in the same manner. In addition to monitoring temperature limits the unit also serves as a pyrometer to indicate the temperature of the device at any given time. The unit is fail-safe and includes a signal light to indicate operation as well as an alarm light indicating when a dangerous condition exists. An alarm circuit allows the unit to be connected to existing plant alarm systems. Initial units are available to control spans as small as 20°F between over-all limits of —100°F and +500°F. Other units are available with over-all spans from —100°F to +1000°F. Delta Design Inc., 3163 Adams Ave., San Diego 16, Calif.
Print No. Ins. 208 on Reader Service Card



Mobile Unit for Quality Control and Reliability Testing

Quality control and reliability testing time and accuracy may be reduced with a new "Space Saver" testing unit. It consists of a roll-about chassis cart and three separate, self-contained cabinets: high-low temperature, humidity, and high heat temperature. Cabinets are available with either mechanical refrigeration or liquid CO_2. Removable for use on or off of the cart, the cabinets allow three individual testing procedures to be conducted at the same time. Cabinet drawers are equipped with work platforms and are interchangeable for crash testing purposes. The cabinets are 24″ x 22″ x 22″ with 12″ x 12″ x 12″ work areas. Testing above and beyond Mil E 5272 C, it is said to be perfect for testing electronic components and instruments. Literature available. Alpha Electric Refrigeration Co., 1115 E. Seven Mile Road, Detroit 3, Mich.
Print No. Ins. 210 on Reader Service Card

Electrically Heated Platens for Thermo-Forming, Other Uses

Electrically heated platens, designed and fabricated to the user's specifications, may be used by the plastic industry for thermo-forming equipment and for attaching labels having heat sensitive adhesives. Each platen employs a multiple circuit, blanket-type heating element which allows heat to be applied either uniformly or in varying watt densities. By variation of element location, hot spots can be created or eliminated, depending on the functional requirements of the unit. Maximum voltage is determined by platen size and configuration. Bulletin HP1 available. Sta-Warm Electric Co., Ravenna, Ohio.
Print No. Ins. 211 on Reader Service Card

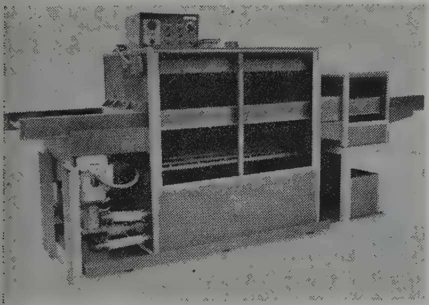
Machine Automatically Marks and Cuts Flexible Plastic Tubing

New automatic tube marking machine designated model ETMA automatically feeds, marks, and cuts to desired length all types of flexible plastic tubing used to produce identification and code markers for wire, cable, hose, and tubing. The Acroleaf model ETMA is designed to produce a marker cut to accurate length with the imprints centered and permanently impressed on the plastic. Acroleaf is a dry heat bond process; therefore, the markers may be used immediately, eliminating all drying problems associated with conventional ink systems. Parts are automatically ejected. The variable speed motor drive permits production of from 60 to 190 pieces per minute, depending on size and length. The feed is adjustable for tube marker lengths ranging from 3/8" to 2". Provided with a self-centering nest with screw adjustment, tube sizes from 1/8" to 1" OD may be processed. Micrometer adjustment for pressure setting is provided. Tube cutters have replaceable carbide cutting faces and adjustable shear pressure. Automatic counter stops the machine when a preset count is reached. Acromark Co., 563 Morrell St., Elizabeth 4, N.J.

Print No. Ins. 212 on Reader Service Card

Printed Circuit Spray Etcher For Volume Production

New spray etching machine for volume production, the model 501 spray etcher, has rackless operation and may be adapted to an automatic conveyorized production line. The machine carries the work horizontally through the etch and rinse chambers, allowing it to be etched and washed top and bottom simultaneously, one operation following the other. Oscillating spray banks and adjustable



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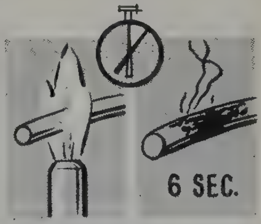
You can rely on tested-approved Varflo for all your Class A and B insulating requirements. With its superior properties of high dielectric strength, flexibility, heat- and flame-resistance, Varflo will meet the most exacting specifications, including MIL-I-21557 and MIL-I-3190.

ON-THE-SHELF: Varflo is economical . . . streamlines and saves on inventory, meeting both Class A and B needs at the Class A price . . . has long shelf life with no deterioration. Why stock two when one will do? Varflo!

ON-THE-JOB: Varflo is dependable . . . withstands hundreds of hours at 300°F . . . resists water, alkalis, mild acids, oil and grease . . . stands up to abrasion, vibration and "after-treating" baking and varnishing . . . has excellent heat-aging qualities. Why specify two when one will do? Varflo!

Available in 10 colors; in coils, spools, 36" lengths or short pieces; all of precise uniformity, end to end. Sizes .010" to 6" ID.

SEND FOR FREE FOLDER containing Varflo test sample and results of laboratory performance ratings.



FLAME RESISTANT—will not support combustion. Varflo is self-extinguishing—in less than 6 seconds after removal from flame.

MORE STABLE—retains dielectric value when pulled back during soldering, etc.

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Print Ins. 38 on Reader Service Card

etchant pressure are employed to preclude differential in etching between top and bottom. Exceptionally fine and uniform work is said to be possible. For printed circuit boards, thin metal parts, and other chemical machining work, undercut is held to a minimum. Line widths of 0.001″ thick are attainable on 1-oz copper printed circuits in production quantities. All common etchants may be used with this etcher. Etch chamber illumination allows operator to adjust etch rate while work is being etched. Chemcut, Division of Centre Circuits Inc., P.O. Box 165, 1101 N. Atherton St., State College, Pa.

Print No. Ins. 213 on Reader Service Card

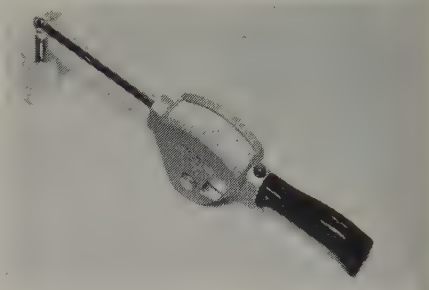
Low-Range Convertible Head For High-Range Strength Testers

Owners of Dillion high capacity testers can now also test in extremely low ranges without buying a separate tester. A new interchangeable low-range head converts all high capacity models into dual use instruments with savings of as much as $1,000. Interchange of the low and high range heads is only a matter of minutes with ordinary tools. Both units provide a portable testing machine that can be moved to wherever the work is to be done. Low-range adaptor heads are available for all Dillion model "LW", "L" and "K" testers. Dial size is 8″ and may be either 4-scale (0 to 10#; 0 to 25#; 0 to 50#; 0 to 100#) or a single scale, 0 to 300#. Four-scale dials are color coded. Dual use of the basic tester provides testing in tensile, transverse, compression, and shear from 0-10# to 0-10,000#. The low-range adaptor heads can be supplied in divisions of ounces, tenths of pounds, or kilos. All dials are individually calibrated with dead weights and are guaranteed accurate to within ½ of 1% of the indicated reading. Price of the single-scale 0-300# capacity low-range adaptor head is $386; price for all 5 scales is $516. W. C. Dillon & Co. Inc., 14620 Keswick St . Van Nuys, Calif.

Print No. Ins. 214 on Reader Service Card

Contactless Temperature Measuring Of Plastics, Other Insulations

The "Kustotherm" is a surface radiation pyrometer for contactless measuring of temperature of plastics, wood, rubber, chemicals, insulating materials, paper, and other nonmetallic materials. It can be used on surfaces of any color, including white, within the limit of permissible error. The swivel radiation head can be directed against vertical, horizontal, or slanted surfaces. The minimum diameter of the measuring surface is 2½″ at a measuring distance of approximately ½″. The range of the instrument is from 50 to 250°C subdivided in two ranges. The paralax-free reading on a large scale is said to be almost instantaneous as only 4 seconds are required for adjustment. Epic Inc., 150 Nassau St., New York 38.



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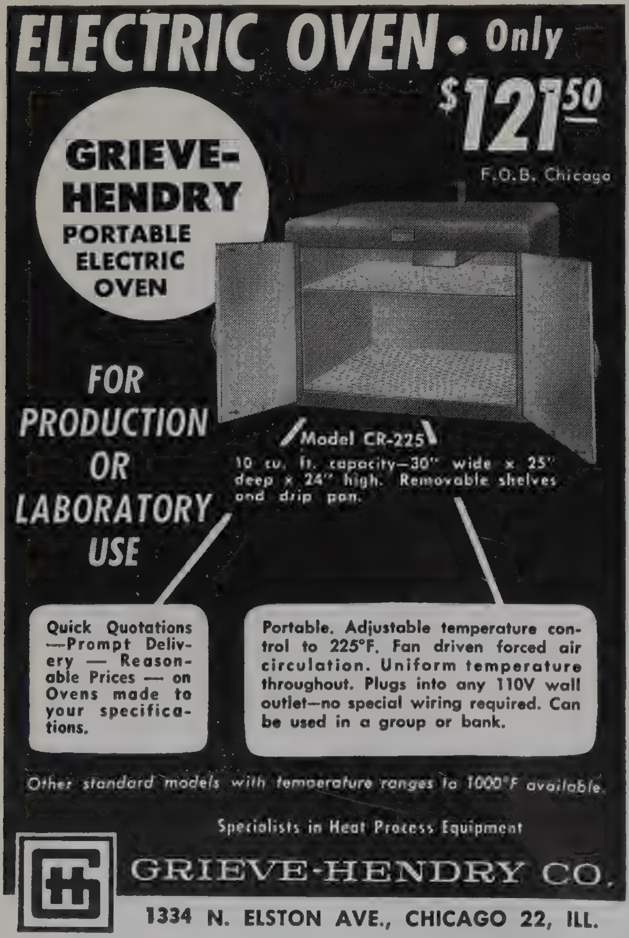

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- Thickness from .004" to .030"
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"Glazed roll" finish — others available.
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Cable and Harness Tester

Series 701 compact cable and harness tester is designed to provide rapid simultaneous continuity and breakdown testing of as many as 17 conductors in a planned sequence. Highly flexible, units are programmed by adjustment of built-in program switches. Plug-in prods permit separate manual testing for both continuity and breakdown without disturbing sequence program. Visual and audible signals indicate rejection or acceptance. Continuity tests are made at a maximum current of 500 ma. Acceptance limit is adjustable between 1 and 5 ohms. Breakdown test voltages of 500, 1000, 1250, 1500, 2000, and 2500 are available. The units may be used singly or in banks for the testing of cables, harnesses, circuit boards, relays, switch panels, and the like—in fact, at any test station requiring several breakdown and continuity tests on an assembly or a completed product. Companion automatic sequencing series 706 is available for applications requiring complete automation of the test sequence. Slaughter Co., Piqua, Ohio.

Print No. Ins. 216 on Reader Service Card

Set Designed for Transformer Testing in Accord with Mil-T-27A

A new high potential insulation breakdown and leakage test set, the "Hypot" model 4075, has been designed to meet the requirements of specification Mil-T-27A, Amendment 3, Paragraph 4.7.5, Item B. This instrument is a combination of two a-c Hypot test sets together with a phase shift network. Thus, two windings of a transformer may be simultaneously tested for leakage to ground by the individual test sets over a range of 0 to 10 kv, a-c. Since the phase relation between the two high voltage outputs from the test set is also continually adjustable from zero to approximately 90 degrees, the potential between the two windings may be varied, and is independently metered as required by this basic military specification for transformer testing. Insulation breakdown for each winding is indicated separately, as well as insulation leakage exceeding a pre-set limit. Associated Research Inc., 3777 W. Bel-

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UNSUPPORTED TAPES: Triangular and rectangular, self-adhering silicone rubber tapes. Triangular tape has a color line at the apex for uniform half-lap winding.

SUPPORTED TAPES: Cured, semi-cured, self-adhering, and uncured silicone rubber tapes in various thicknesses and base fabrics.

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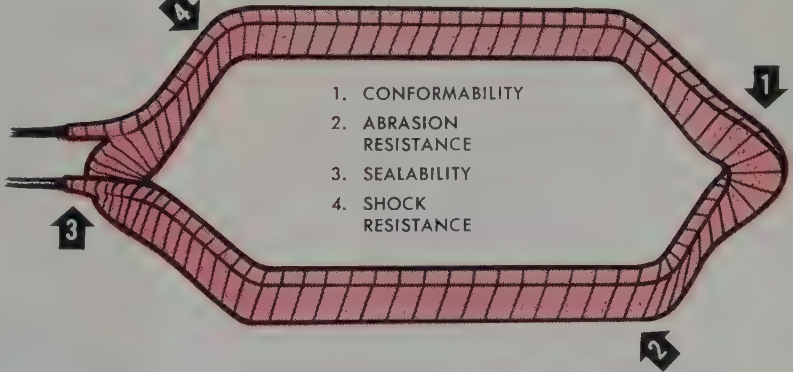

ELECTRICAL AND INDUSTRIAL SPECIALTY TAPES

CHR CONNECTICUT HARD RUBBER CO.

Main office: New Haven 9, Connecticut

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mont Ave., Chicago 18.
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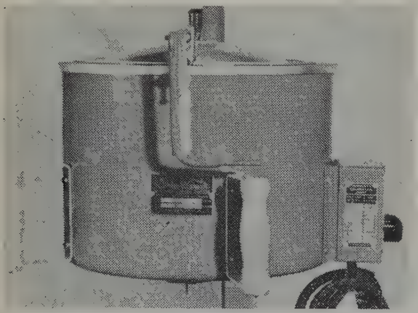
Longer Lasting Bandsaw Blades

Dialloy is a new metal for diamond-coated bandsaw blades. The new metal reportedly has superior fatigue resistance and in tests outlasts steel three to four times. Diachrome Inc., 612 W. Elk Ave., Glendale 4, Calif.
Print No. Ins. 218 on Reader Service Card

Electrically Heated Overhead Mounted Materials Dispenser

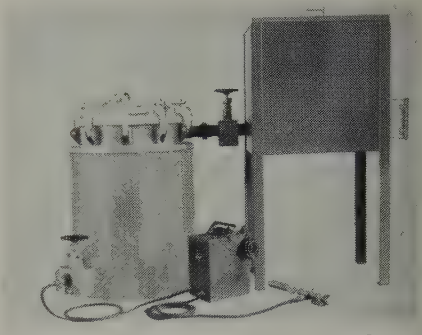
Overhead mounted dispensers are designed for filling equipment too large or heavy to move to stationary-type dispensing units. Dispensing of heated materials such as waxes, thermoplastic, and other industrial compounds is accomplished by maneuvering unit to a position directly over the object to be filled. The unit is suspended by a sling and is equipped with two grab handles. By means of a conveniently located thumb control, both hands remain on the grab handles for accurate dispensing operations. Heat is uniformly applied to the entire bottom and 75% of the side walls by multiple circuit, blanket-type heating element. Units are designed for 115 v and 230 v single phase and for temperatures from 150° to 550°F. Other voltages and temperature ranges are available on special order. Bulletin D2 available. Sta-Warm Electric Co., Ravenna, Ohio.



Print No. Ins. 219 on Reader Service Card

Assemblies for Spraying and Flowing Insulating Materials

Electrically heated, multiple unit, low pressure assemblies are suitable for spraying or flowing of many different industrial compounds such as waxes, asphaltic compounds, resins, and sealants. Multiple unit low pressure assemblies are also used in the manufacture of insulating materials. Consisting of one or two premelters, low pressure tank, valves, piping systems, or manifolds and hoses, these assemblies are said to be particularly adaptable where there is a need for flowing or spraying a highly viscous material. Premelters are available in a number of different materials, shapes, and temperature ranges and are available with or without motor driven agitators. Flexible, "Teflon"-lined hose, shielded in braided stainless steel and enclosed in an extruded Teflon protective sleeve, is used for conveying material to point of application. Sta-Warm Electric Co., North Chestnut St., Ravenna, Ohio.



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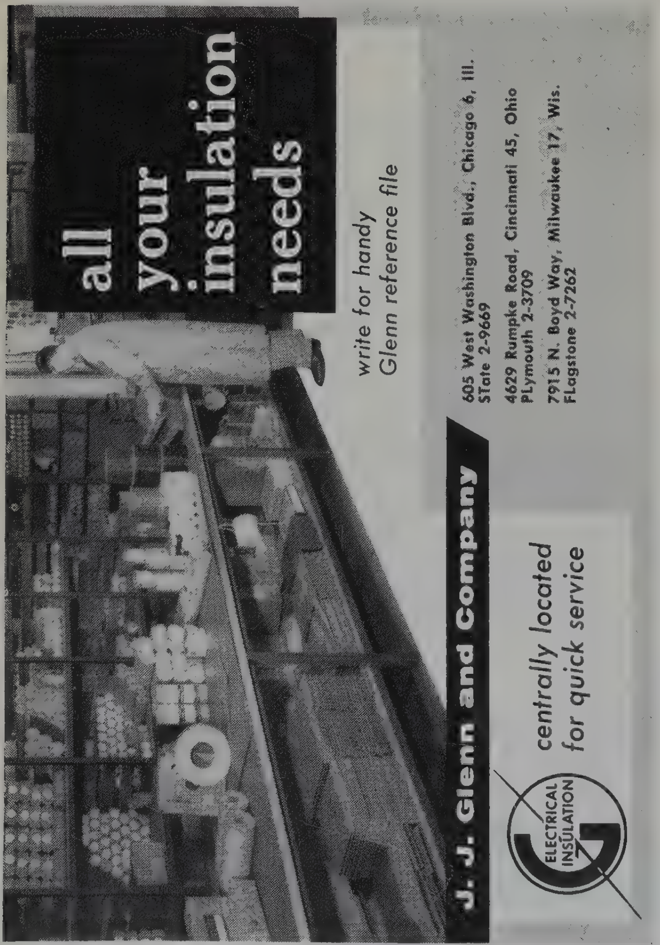
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★ New Measuring Cutter

Cut tying time in half! Hanscom-Ties (colorful plastic or paper covered wire) are the fast, sure way to bundle wires, cords, coils, etc. . . . temporarily and permanently. New Measuring Cutter dispenses faster than ever! Ties are cheaper by the spool (as little as 9 ft. for a penny!)

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$7.95 Complete

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New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card — no postage is required. Insulation *immediately forwards your requests to the companies concerned so that the literature can be sent to you promptly.*

Plastics Properties and End Use Fact File

A revised plastics fact file describes the properties and typical end uses of a diversified line of materials. It includes detailed results of ASTM tests on broad range of styrene, polyethylene, vinyl chloride and SAB and SAN molding and extrusion compounds. Also featured is general information about the forms, typical uses, and characteristics of fabricating, extruding, calendering, and laminating materials; industrial, textile, surface, and paper coating resins; adhesives; and intermediates. 16 pages. Dept. FF, Monsanto Chemical Co., Springfield 2, Mass.

Print No. Ins. 302 on Reader Service Card

Pressure-Sensitive Tapes Selector

New booklet, DB-56A, contains information on types of pressure-sensitive tapes available, how they are constructed, and the factors involved in choosing a particular tape for a specific application. It also includes an introduction that discusses factors influencing choice of a tape, a section defining a P-S tape, a page devoted to trouble-shooting problems concerned with tape failures, a glossary of tape terminology, and a listing of available technical literature. 4 pages. Johns-Manville, Dutch Brand Div., 22 East 40th St., New York 16.

Print No. Ins. 303 on Reader Service Card

Polycarbonate Resin Price And Product Data Sheets

Price and product data sheets on new "Lexan" 102 polycarbonate, a nearly water-white, color-stabilized resin, give complete electrical, physical, and thermal properties and latest prices. 4 pages. Chemical Materials Dept., General Electric Co., One Plastics Ave., Pittsfield, Mass.

Print No. Ins. 304 on Reader Service Card

Metering and Mixing Systems Bulletin

New bulletin describes features and use of equipment for the metering and mixing of polyurethanes, epoxies, polyesters, polysulphides, liquid elastomers, and other multi-component reactive liquid resin mixes. 4 pages. Novo Industrial Corp., Mitchell Specialty Div., Edmund and Shelmire Sts., Philadelphia 36, Pa.

Print No. Ins. 305 on Reader Service Card

Brochure on New Rigid PVC Electrical Conduit

Brochure describes a new line of rigid PVC plastic pipe newly approved for use as electrical conduit. Complete specifications and suggested applications are provided for the nonconducting, non-corrosive plastic conduit, which is listed by Underwriters' Laboratories Inc., for direct underground burial or encasement in concrete. Coupling, elbow, expansion joint, and adapter shapes and sizes also are detailed. 8 pages. Lasco Industries, 1561 Chapin Rd., Montebello, Calif.

Print No. Ins. 306 on Reader Service Card

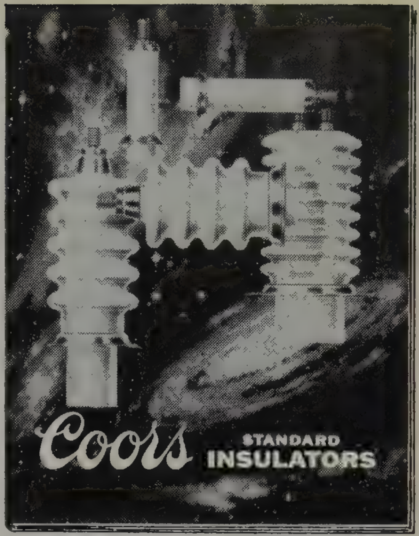
Catalog of Electrical Testers

Short form catalog briefly describes and illustrates many electrical test sets, among them an automatic high potential dielectric tester for multiconductor devices. 2 pages. Industrial Test Equipment Co., 55 E. 11th St., New York 3.

Print No. Ins. 307 on Reader Service Card

Bulletin Describes Molding Compounds, Fire-Retardant Resins, Urethane Foams

The who, when, where, and why of molding compounds, fire-retardant resins, and urethane foams are given in a new bulletin D400. It is the first edition to include information on a



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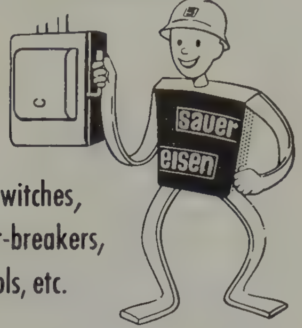

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recently-introduced family of fire-retardant rigid urethane foams. Purposes, properties, and uses of phenolic molding compounds are described in charts, illustrations, and text. Another section suggests when to use fire-retardant resins for reinforced plastics. Bonding and coating resins are also covered. 8 pages. Hooker Chemical Corp., Durez Plastics Div., North Tonawanda, N.Y.

Print No. Ins. 308 on Reader Service Card

Bulletin on Equipment For Continuous Wire Processing

Bulletin GED-4331 describes wire handling equipment for continuous wire processing that is designed to deliver optimum wire quality at minimum cost. Photo with call-outs shows major components of the equipment. Close-up pictures explain operation of various mechanisms. Chart gives dimensions for both supply stand and pick up sections of the equipment. 4 pages. General Electric Co., Schenectady 5, N.Y.

Print No. Ins. 309 on Reader Service Card

Bulletin Describes Screw and Plunger Plastics Injection Molding Machines

Bulletin 601 describes new 12-20 oz screw and plunger type injection molding machines. Design features, both standard and optional, are described in detail. Included are complete specifications and die space dimensions. 4 pages. Farrel-Birmingham Co. Inc., Watson-Stillman Press Div., 565 Blossom Road, Rochester 10, N.Y.

Print No. Ins. 310 on Reader Service Card

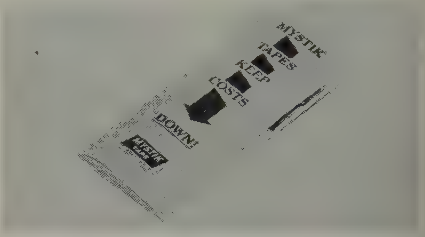
Conductive Cements Bulletin

New bulletin discusses conductive cements in detail. Subjects covered include thermosetting silver cements; thermosetting gold cements; adhesion, resistance, and viscosity testing procedures; thinners; and storage. A chart gives the adhesive and electrical properties of conductive cements. 4 pages. Electrochemicals Dept., Ceramic Products Div., E. I. du Pont de Nemours & Co. Inc., Wilmington 98, Del.

Print No. Ins. 311 on Reader Service Card

Guide to Cost-Cutting Tapes

A new guide to pressure-sensitive tapes, titled "Mystik Tapes Keep Costs Down!," gives handy reference data on a full line of electrical and other types of tapes, protective coverings, and specialties. Typical applications are suggested where the tapes can save time and money. The guide is pocket-sized for convenience. A quick reference index speeds up the selection of tapes. 44 pages. Industrial Div., Mystik Adhesive Products Inc., 2635 No. Kildare Ave., Chicago 39.



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Booklet on Processing of Cast Polypropylene Films

A new technical booklet is said to be the first to provide information on the processing of cast polypropylene films. It is divided into four main sections: markets, properties, processing, converting and packaging. Technical data includes typical electrical and other property ranges of "Pro-fax" polypropylene film and a table which compares competitive films. The processing section includes 40 charts. 12 pages. Polymers Dept., Hercules Powder Co., Hercules Tower, 910 Market St., Wilmington 99, Del.

Print No. Ins. 313 on Reader Service Card

Uses of Pour-In-Place Urethane Foams Illustrated in New Booklet

A new booklet illustrating the versatility and varied uses of pour-in-place urethane foams for potting and other uses contains many illustrations. Cost, handling, and electrical and other properties are covered. It also discusses outstanding benefits provided in many such uses as potting sensitive electronic and guidance systems. 12 pages. Plastics Div., Nopco Chemical Co., 175 Schuyler Ave., North Arlington, N.J.

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Data Sheets on Beryllium Oxide Insulation

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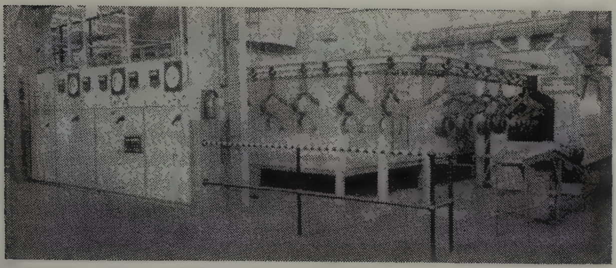

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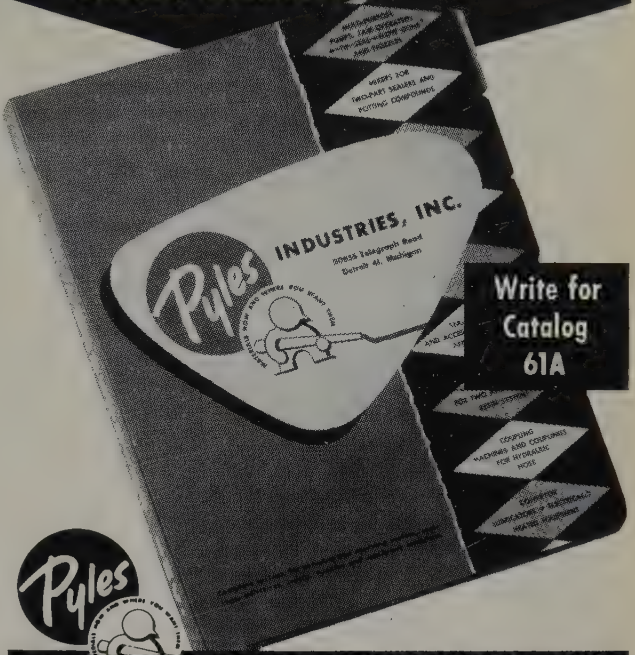
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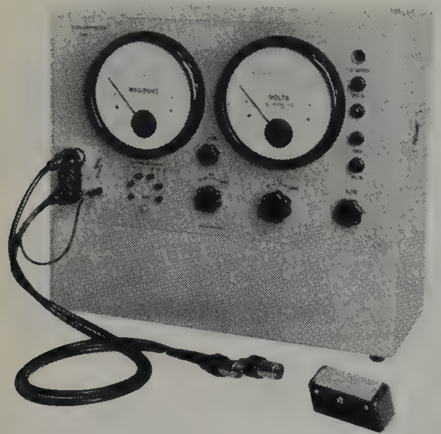

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insulating bodies are provided in new data sheets. One covers B-6 bodies said to be readily metallized and producible in pressed parts such as discs, blocks, and plates. The other refers to F-1 bodies producible in extruded parts such as bars, rods, and tubes. 2 pages. The Brush Beryllium Co., 5209 Euclid Ave., Cleveland 3, Ohio.
Print No. Ins. 315 on Reader Service Card

Bulletin on Irradiated Polyolefin Wire

Features, typical properties, and test specifications for "Electroset" S/E irradiated polyolefin wire are given in a new bulletin. It lists availabilities of the insulated hook-up wire and multiconductor cable in sizes AWG 8-30 and in a full range of colors. 2 pages. Radiation Materials Inc., 36-32 37th St., Long Island City 1, N.Y.
Print No. Ins. 316 on Reader Service Card

Tubings and Sleevings Booklet

New booklet is designed as a reference aid in specifying "Irvington" brand tubings and sleevings for electrical insulation in class A through class H temperature applications. It contains sections on how to pick the right tubing or sleeving, NEMA grading, methods of applying tubing and sleeving insulations, and useful storage tips. Extruded tubings and coated sleevings of all types are included in the descriptions. Selector charts graphically illustrate the useful temperature ranges, electrical strength, chemical resistance at room temperature, resistance to cut-through, and relative flexibility. 12 pages. Dept. W1-358, Irvington Div., Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.
Print No. Ins. 317 on Reader Service Card

Bulletin on 'Teflon' Extrusion, Molding, and Fabrication

A new brochure announces firm's ability to extrude, as well as mold and machine, Teflon in rod, tube, and shapes. The folder illustrates some of the parts already produced, contains a chart of electrical and other properties of Teflon, and illustrates other parts, in other plastics, that are manufactured to specification. Comco Plastics Inc., 98-34 Jamaica Ave., Richmond Hill 18, N.Y.
Print No. Ins. 318 on Reader Service Card

Solar Radiation Simulators Data

Catalog 3118 describes standard solar radiation simulators, accessories, and power supply used for testing space vehicles and their components. 1 page. Genarco Inc., 97-04 Sutphin Blvd., Jamaica 35, N.Y.
Print No. Ins. 319 on Reader Service Card

Seal and Fastener Master Catalog

Comprehensive master catalog 359B provides complete information on an entire line of explosion and high-pressure seals for switches and shafts, high-pressure self-sealing fasteners, transparent and flexible switch seals, power connectors with auto-deflecting grounding blades, and other products. Included for the first time are fasteners with resilient nylon pellets for added reliability and thread-locking action. Among recently developed products listed are high pressure, self-sealing captive screws and molded silicone O-rings. Dimensional drawings, part numbers, other technical data, complete specifications, and ordering instructions are included. 16 pages. A. P. M. Corp., 4 Honeck St., Englewood, N.J.
Print No. Ins. 320 on Reader Service Card

Booklet on Aluminum Electrical Conductors, Stranded-Bare

New data on conductors, core wires, cable reels, and conductor lengths have been incorporated into a revision of booklet titled "Aluminum Electrical Conductors, Stranded-Bare." The revision includes—for the first time—information on 5005 aluminum alloy conductors, aluminized steel core wire for ACSR (aluminum conductor, steel reinforced), and details on a new size of expanded ACSR—2,294 MCM, 2.32" diameter. The new publication presents, as its principal content, separate physical characteristics and packaging tables for ACSR and stranded aluminum conductors. It also offers conductor cross-section diagrams, and reel and coil data. 24 pages. Rome Cable Div., Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.
Print No. Ins. 321 on Reader Service Card

Experimental Fiber Sheet Structures with Class H Electrical and Mechanical Properties

Ed. Note: In the *News and Views* feature of the July issue of *Insulation*, brief mention was made of Du Pont's new HT-1 electrical insulation fiber with high temperature resistance. This story, which represents the latest and most complete information available, provides additional details exclusively for readers of *Insulation*.

•

HT-1 is the designation for a high temperature-resistant fiber (density 1.38) being produced on an experimental scale by Du Pont. It is expected to have important electrical insulation applications, and more data on electrical properties will be reported in the future as information becomes available.

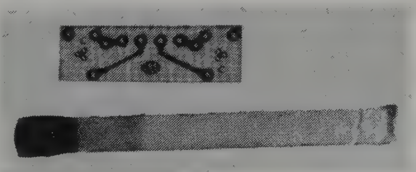
Generically HT-1 is a polyamide, but it differs from conventional nylon fibers by its ability to perform acceptably in high-temperature applications above the melting point of existing polyfibers (482°F for Type 66 nylon). At this temperature, HT-1 retains well over half of its room temperature strength of six grams per denier. In addition, it does not melt and is ignited only with difficulty at temperatures above 1,000°F, decomposing in the process to a friable char. Other physical characteristics include a high modulus (150 to 160 grams per denier) and dimensional stability either to boil-off (two percent shrinkage) or high-temperature dry heat (five percent shrinkage at 650°F). HT-1 is also characterized by good resistance to oxidative degradation, acids, bases, and high-energy beta or gamma radiation. HT-1 fibers can also be formed into sheet structures which exhibit mechanical and electrical properties characteristic of class H (359°F) electrical insulation.

The limited quantities of HT-1 now available are being channeled into end-product evaluations, primarily of an industrial nature, to define the performance advantages this fiber can offer in high-temperature applications such as coated fabrics and electrical insulation. Military problems of a more specific nature also are being explored. A pilot unit is now under construction at Richmond, Va. It is expected to be on-stream during the fourth quarter of 1962. The output of this pilot unit will be used to develop additional information on uses in more detail than is presently possible and to permit market development activity into some areas of interest.

HT-1 is currently being produced as a continuous filament yarn of 200 denier, 100 filaments with approximately one to 1.5 turns of "Z" twist. Where necessary, twist-setting can be accomplished through the use of steam at 30 pounds per square inch for 5 to 10 minutes. A recommended sizing procedure for warp yarns prior to weaving includes the use of standard polyvinyl alcohol sizes applied under conditions recommended for "Dacron" polyester fiber. The experimental shipping package is a seven-inch, three degrees/30 minutes cone core weighing approximately one and one-half pounds, containing a maximum of three faced knots.

Tiny Printed Circuit Board

To produce a printed circuit board for the world's smallest commercially-available electronic module—a module with a density of two million component parts per cubic foot—Cleveland Metal Specialties uses Formica FF-91. The stability, machinability, and high insulation resistance of the plastic laminate reportedly result in a well-engineered "mother board," to which component parts are installed. Direct mounting eliminates the standard module board. The photo shows a circuit board, less than one inch long, compared with an ordinary paper match.



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Dates to Circle

Meeting and Convention Notices

Oct. 1-5 . . . Electrochemical Society, Statler Hotel, Detroit, Mich.

Oct. 2-4 . . . IRE; Canadian Electronics Conference, Automotive Building, Exhibition Park, Toronto, Canada.

Oct. 5 . . . Plastic Foams, Retec sponsored by Buffalo Section, SPE, Niagara Falls, N.Y.

Oct. 9-11 . . . National Electronics Conference, sponsored by AIEE, IRE, Illinois Institute of Technology, Northwestern University, and the University of Illinois, International Amphitheatre, Chicago.

Oct. 9-11 . . . Fall Meeting of Committee D-27 on Electrical Insulating Liquids and Gases, ASTM, Hotel Cavalier, Virginia Beach, Va.

Oct. 10-12 . . . ASA, 12th National Conference on Standards, Rice Hotel, Houston, Texas.

Oct. 10-12 . . . Joint Conference on Nuclear Reactor Chemistry—Analytical Chemistry in Nuclear Reactor Technology, Oak Ridge National Laboratory, Gatlinburg, Tenn.

Oct. 11 . . . Institute of Printed Circuits, Fall Symposium, Sheraton Hotel, Chicago.

Oct. 12-13 . . . SPI, 17th Annual New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N.H.

Oct. 15-20 . . . AIEE, Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich.

Oct. 23-25 . . . Conference on Electrical Insulation, National Academy of Sciences—National Research Council, Pocono Manor Inn, Pocono Manor, Pa.

Oct. 23-25 . . . IRE, East Coast Conference on Aerospace and Navigational Electronics, Lord Baltimore Hotel, Baltimore, Md.

Oct. 23-26 . . . The Wire Association, Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

Oct. 25 . . . SPE, Plastics in Major Household Appliances, sponsored by Kentuckiana Section, Monogram Hall, Appliance Park, Louisville, Ky.

Oct. 26-28 . . . IRE, Electron Devices Meeting, Sheraton-Park Hotel, Washington, D.C.

Oct. 30-Nov. 1 . . . IRE, Radio Fall Meeting, Hotel Syracuse, Syracuse, N.Y.

Nov. 6 . . . AIEE, Third Western Technical Conference, Biltmore Hotel, Los Angeles, Calif.

Nov. 6-8 . . . 6th Annual Special Technical Conference on Nonlinear Magnetics, AIEE and IRE, Statler-Hilton Hotel, Los Angeles, Calif.

Nov. 7-9 . . . Eighth Industrial Electric Exposition, Electric League of Western Pennsylvania, Pittsburgh Room, Penn-Sheraton Hotel, Pittsburgh, Pa.

Nov. 13-16 . . . 7th Annual Conference on Magnetism and Magnetic Materials, AIEE and American Institute of Physics, Hotel Westward Ho, Phoenix, Ariz.

Nov. 14-16 . . . IRE, Northeast Electronics Research and Engineering Meeting, Boston, Mass.

Nov. 15-17 . . . Aerospace Electrical Society, Annual Display, Pan Pacific Auditorium, Los Angeles, Calif.

Nov. 16 . . . NEMA, Annual Meeting, Plaza Hotel, New York City.

Nov. 21 . . . Manufacturing Chemists Association Inc., Semi-Annual Meeting and Midyear Conference, New York City.

Nov. 29-Dec. 1 . . . Tenth Annual Wire and Cable Symposium, jointly sponsored by U. S. Army Research and Development Laboratory and Industry, Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 1 . . . SPE, Plastics Screw Injection Molding, Retec sponsored by Cleveland Section, Cleveland Engineering Society Building, Cleveland, Ohio.

Dec. 12-14 . . . Eastern Joint Computer Conference, sponsored by AIEE, IRE, and Association of Computer Manufacturers, Sheraton-Park Hotel, Washington, D.C.

Jan. 9-11 . . . Eighth National Symposium on Reliability and Quality Control, sponsored by IRE, EIA, AIEE, and American Society for Quality Control, Statler Hilton Hotel, Washington, D. C.

Jan. 29-Feb. 2 . . . AIEE, Winter General Meeting and First National Electrical Engineering Exposition, Hotel Statler and the Colisem, New York City.

Jan. 30-Feb. 2 . . . SPE, 18th Annual Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa.

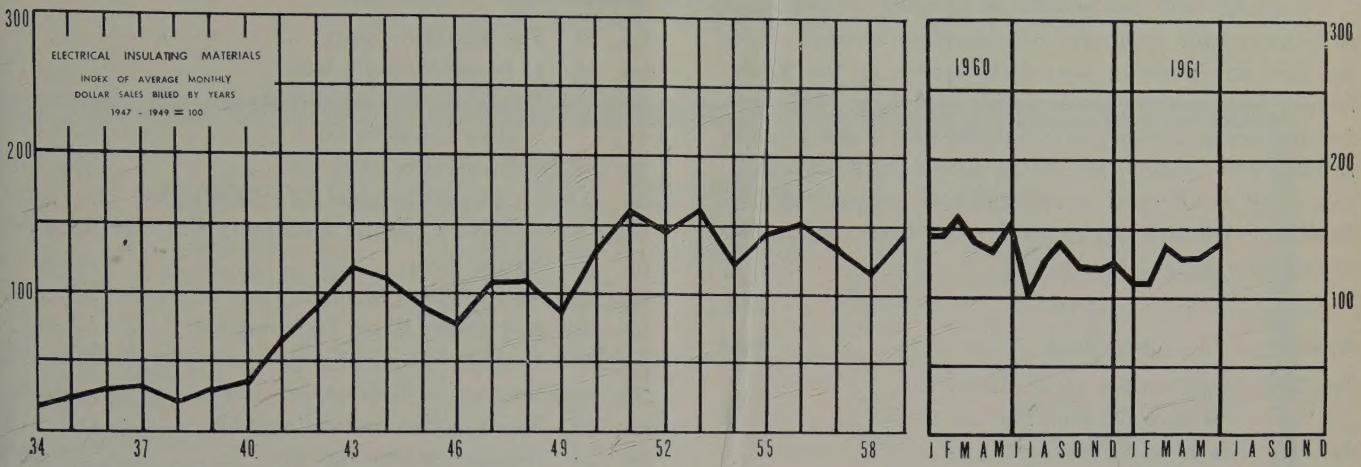
Feb. 5 . . . Committee Week, Committee D-27 on Electrical Insulation Liquids and Gases, ASTM, Statler Hilton Hotel, Dallas, Texas.

Feb. 19-22 . . . Fourth Electrical Insulation Conference and Exhibition, Shoreham Hotel, Washington, D. C.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing Materials	EASA	—Electrical Apparatus Service Assn.
ASME	—American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index



	June '61	May '61	June '60
Index Series	139	129	152
June '61 point change from other mos.		+10	−13
June '61 % change from other months		+11	− 9

Index is based on 1947-1949 average month, inclusive= 100

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Materials Used in Electrical Insulation Index

- Industrial Laminated Products
- Manufactured Electrical Mica
- Flexible Electrical Insulation
- Vulcanized Fibre
- Coated Electrical Sleeving

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Operating Costs
Equipment Investment
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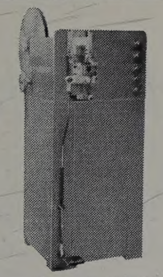
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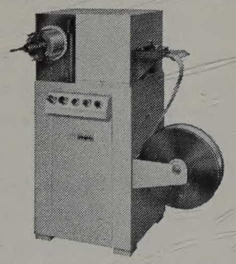
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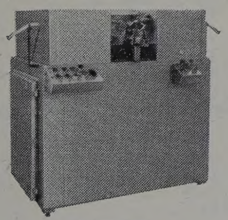
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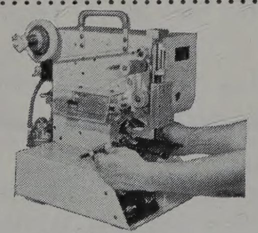
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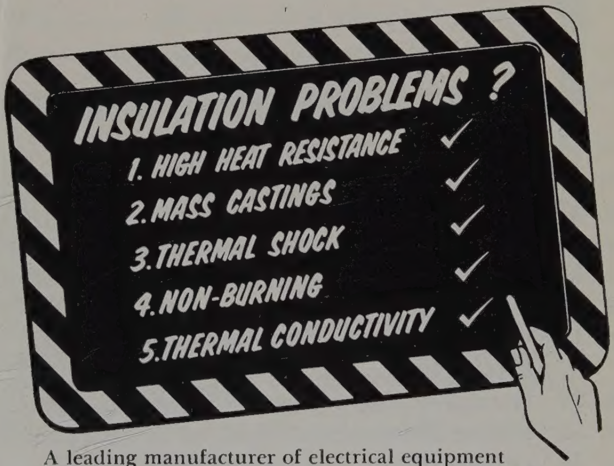

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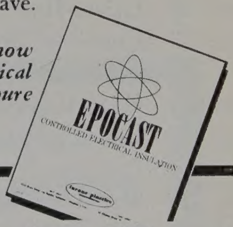

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	Water Absorption (% 24 hr. @ 25C)	Flexural Strength (lbs./sq. in.)		Impact Strength (ft. lb./in. notch)	Arc Resistance (seconds)	Dielectric Strength parallel to laminate D-336/50 (KV/in.)	Approx. Price $/lb.
		Cond. A	E-200/150				
Glass/Melamine MIL-P-15037 (GMG) requirements	2.7	50,000	< 30,000*	13	180	≪ 5*	$2.50
Glass/Melamine MIL-P-15037 (GME) requirements	0.8	60,000	30,000	7	180	50	$2.50
Glass/Melamine Textolite® 11588 (typical values)	**0.25**	**88,000**	**45,000**	**16**	**183**	**60**	**$2.50**
Glass/Polyester PO-1 (Typical Industry Values)	1.0	23,900	10,750*	8	100	19*	$1.00
Glass/Epoxy G-10 (Typical Industry Value)	0.35	63,200	5,050*	9	60	30*	$3.10
Glass/Silicone G-7 (Typical Industry Values)	0.35	30,000	18,000*	6.5	185	16*	$6.50

*Test values not required by specifications

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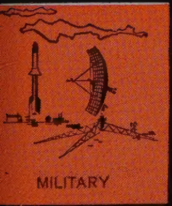
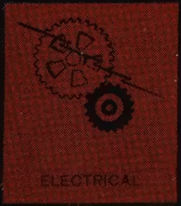
A look at the chart above and you will see that here is a unique glass/melamine laminate with excellent moisture resistance and flexural strength. In addition, 11588 has good impact and dielectric strength, as well as being highly arc resistant. If you have applications that have required epoxy-based laminates, for example, see if this glass/melamine might not be suitable, at lower cost.

Designed primarily for use by electrical apparatus and appliance manufacturers, 11588's unusual combination of properties makes it highly attractive as an insulator for a multitude of electrical and electronic application. The relatively low cost per pound plus its outstanding characteristics, make this laminate ideal for use as slot wedges, terminal boards, transformer spacer blocks and . . . well, you name it.

You may be using any one of the materials above for a particular property it possesses. If so, look closely at G-E Textolite G-5 11588. It may have the property you need plus **additional** desirable properties. Many applications certainly must demand such favorable combinations — what can you do with these properties? We will be happy to work with you or send complete information and samples. Write: Laminated Products Department, Section I-91, General Electric Company, Coshocton, Ohio.





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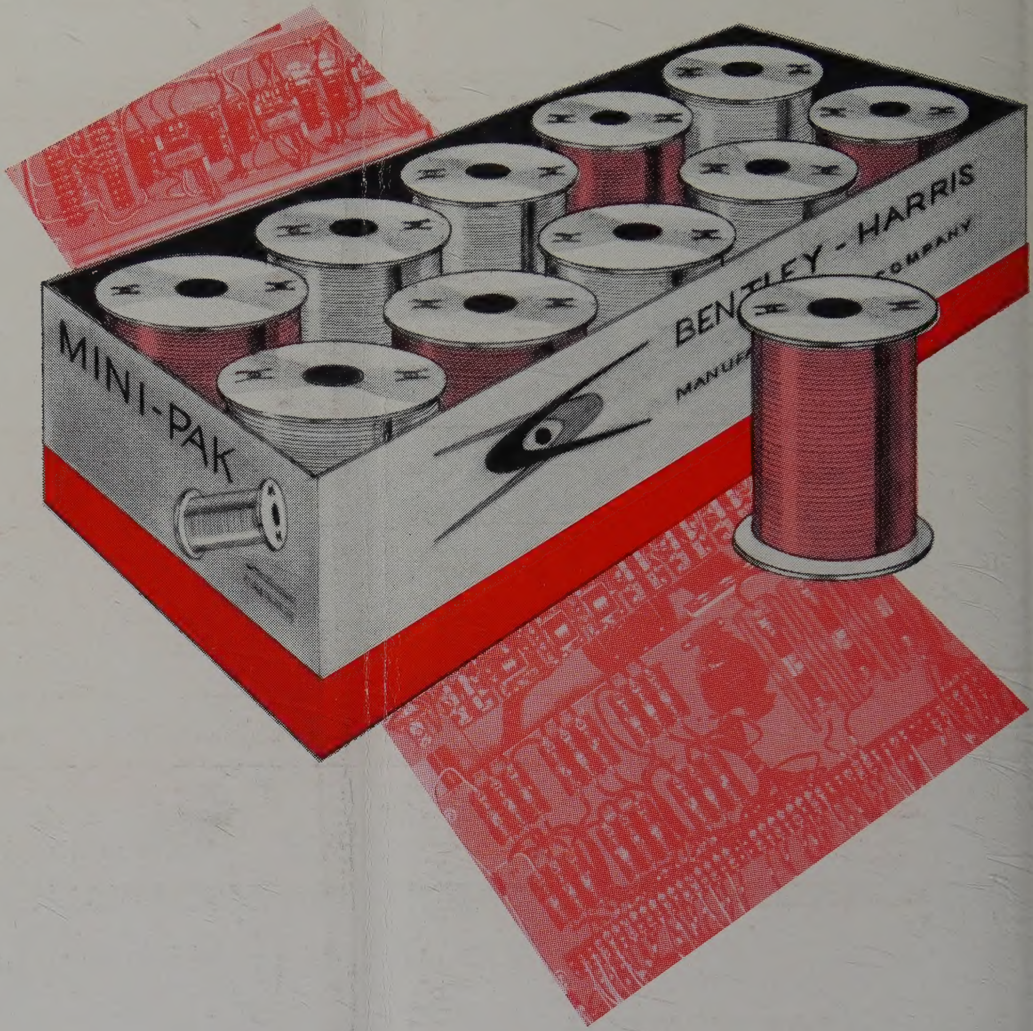

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